# *WELDON SPRING QUARRY/PLANT/PITS (USDOE/ARMY)*

## Site Information:

**Site Name:** WELDON SPRING QUARRY/PLANT/PITS (USDOE/ARMY)
**Address:** ST. CHARLES COUNTY, MO

**EPA ID:** MO3210090004
**EPA Region:** 07

## Record of Decision (ROD):

**ROD Date:** 09/28/1990
**Operable Unit:** 04
**ROD ID:** EPA/ROD/R07-90/043

**Media:** SOIL SLUDGE DEBRIS

**Contaminant:** ORGANICS, PCBS, PAHS, RADIOACTIVE MATERIALS, METALS, ARSENIC, LEAD

**Abstract:** THE 226-ACRE WELDON SPRING QUARRY/PLANT/PITS (USDOE) SITE IS A FORMER ORDNANCE WORKS AND CHEMICAL PLANT NEAR THE CITY OF WELDON SPRING IN ST. CHARLES COUNTY, MISSOURI. THE SITE IS DIVIDED INTO TWO NONCONTIGUOUS AREAS: A 217-ACRE CHEMICAL PLANT AREA, COMPRISED OF VARIOUS BUILDINGS, PONDS AND FOUR RAFFINATE PITS, AND A 9-ACRE QUARRY, WHICH FORMS A VALLEY WALL AT THE EDGE OF THE MISSOURI RIVER FLOODPLAIN. SINCE THE EARLY 1940S, THE SITE HAS BEEN USED BY VARIOUS GOVERNMENT AGENCIES FOR CHEMICAL AND ORDNANCE PROCESSING WITH CHEMICAL AND RADIOACTIVE WASTE DISPOSAL IN THE QUARRY. FROM 1941 TO 1946, THE SITE WAS AN ARMY ORDNANCE WORKS USED FOR THE PRODUCTION OF TRINITROTOLUENE (TNT) AND DINITROTOLUENE (DNT) EXPLOSIVES, AND THE QUARRY WAS USED TO DISPOSE OF THE CHEMICAL WASTES. FROM 1955 TO 1966 THE ATOMIC ENERGY COMMISSION (AEC), THE PREDECESSOR TO THE DEPARTMENT OF ENERGY, CONSTRUCTED AND OPERATED THE CHEMICAL PLANT FOR PROCESSING URANIUM AND THORIUM. TYPES OF WASTES DISPOSED OF ONSITE INCLUDED URANIUM AND THORIUM ORE

RESIDUES (DRUMMED AND UNCONTAINED), RADIOACTIVELY CONTAMINATED BUILDING DEBRIS, PROCESSING EQUIPMENT, AND RESIDUES OF TNT AND DNT FROM CLEANUP OF THE FORMER ORDNANCE WORKS. EXCEPT FOR PARTIALLY DECONTAMINATING BUILDINGS AND DISMANTLING SOME EQUIPMENT, THE SITE HAS NOT BEEN USED SINCE 1967. IN 1990, EPA RELEASED A REMEDIAL INVESTIGATION/FEASIBILITY STUDY AND PROPOSED PLAN, WHICH DOCUMENTED FIVE REMEDIAL ACTIONS FOR THE QUARRY. THE FIRST REMEDIAL ACTION INVOLVES TREATING CONTAMINATED SURFACE WATER, FOLLOWED BY DISCHARGE OF TREATED WATER TO THE MISSOURI RIVER. THE SECOND REMEDIAL ACTION, WHICH IS DOCUMENTED IN THIS RECORD OF DECISION (ROD), ADDRESSES INTERIM DEPOSITION OF BULK WASTES IN THE QUARRY TO MINIMIZE FUTURE GROUND WATER AND AIR CONTAMINATION AND TO FACILITATE ADDITIONAL CHARACTERIZATION OF WASTE AND RESIDUALS IN AND AROUND THE QUARRY. FINAL DECISIONS FOR DISPOSAL OF WASTES WILL BE MADE IN A SUBSEQUENT ROD FOR THE CHEMICAL PLANT. FUTURE REMEDIAL ACTIONS WILL ADDRESS MATERIALS REMAINING IN THE QUARRY WALLS AND FLOOR, GROUND WATER CONTAMINATION, AND CONTAMINATED PROPERTIES OUTSIDE THE QUARRY. THE PRIMARY CONTAMINANTS OF CONCERN AFFECTING THE QUARRY SOIL, SLUDGE, AND DEBRIS ARE ORGANICS INCLUDING PCBS AND PAHS; RADIOACTIVE MATERIALS; AND METALS INCLUDING ARSENIC AND LEAD.

THE SELECTED INTERIM REMEDIAL ACTION FOR THIS SITE INCLUDES EXCAVATING AN ESTIMATED 95,000 CUBIC YARDS OF CHEMICALLY AND RADIOACTIVELY CONTAMINATED BULK WASTES FROM THE QUARRY AND TEMPORARILY STORING THE WASTES ONSITE IN THE CHEMICAL PLANT AREA; AND IMPLEMENTING SITE ACCESS RESTRICTIONS. THE ESTIMATED TOTAL COST FOR THIS REMEDIAL ACTION IS $11,000,000. THERE ARE NO O&M COSTS ASSOCIATED WITH THIS REMEDIAL ACTION.

PERFORMANCE STANDARDS OR GOALS; NOT PROVIDED. INSTITUTIONAL CONTROLS; NOT APPLICABLE.

**Remedy:** THIS OPERABLE UNIT REMEDIAL ACTION IS THE SECOND OF FIVE RESPONSE ACTIONS PLANNED AS PART OF THE OVERALL REMEDIAL ACTION FOR THE WELDON SPRING QUARRY. THE FIRST RESPONSE ACTION TO BE INITIATED AT THE QUARRY IS A REMOVAL ACTION INVOLVING TREATMENT OF CONTAMINATED SURFACE WATER AND DISCHARGE OF THE TREATED WATER TO THE MISSOURI RIVER. THE QUARRY WATER REMOVAL ACTION IS EXPECTED TO BE INITIATED IN 1991. THE FUNCTION OF THIS OPERABLE UNIT IS TO REMOVE BULK WASTES FROM THE QUARRY. THIS WILL ELIMINATE THE WASTES AS A POTENTIAL CONTINUING SOURCE OF GROUNDWATER CONTAMINATION AND MINIMIZE RISKS ASSOCIATED WITH EXPOSURE TO CONTAMINANTS RELEASED INTO THE AIR. IT WILL ALSO FACILITATE ADDITIONAL CHARACTERIZATION OF THE WASTES AND RESIDUAL CONTAMINATION IN AND AROUND THE QUARRY. BULK WASTES ARE DEFINED AS MATERIALS THAT CAN BE REMOVED FROM THE QUARRY USING STANDARD EQUIPMENT AND PROCEDURES. THIS REMEDIAL ACTION IS NOT THE FINAL REMEDIAL ACTION FOR THE QUARRY, AND IT DOES NOT ADDRESS FINAL DISPOSITION OF THE BULK WASTES. DISPOSAL DECISIONS FOR THESE WASTES WILL BE MADE AS PART OF THE REMEDIAL ACTION DECISION FOR THE CHEMICAL PLANT AREA OF THE WELDON SPRING SITE. A DECISION ON THE FINAL REMEDIAL ACTION FOR THE QUARRY WILL BE MADE IN A SUBSEQUENT DECISION MAKING PROCESS AFTER THE BULK WASTES HAVE BEEN REMOVED.

THE MAJOR COMPONENTS OF THE SELECTED REMEDY INCLUDE;
* REMOVAL OF THE BULK WASTES FROM THE QUARRY USING STANDARD EQUIPMENT AND PROCEDURES.
* TRANSPORTING THE BULK WASTES ALONG A DEDICATED HAUL ROAD TO THE CHEMICAL PLANT AREA OF THE WELDON SPRING SITE.
* PLACING THE BULK WASTES IN CONTROLLED STORAGE IN AN ENGINEERED TEMPORARY STORAGE FACILITY.

FOLLOWING REMOVAL OF THE WASTES, DETAILED STUDIES WILL BE MADE OF THE EMPTY QUARRY AND LOCAL GROUNDWATER SYSTEM. THESE STUDIES WILL FACILITATE DECISIONS WITH REGARD TO THE THREE REMAINING COMPONENTS OF THE QUARRY REMEDIAL ACTION, I.E., (1) RESIDUAL MATERIALS REMAINING IN

THE QUARRY WALLS AND FISSURES, (2) GROUNDWATER, AND (3) VICINITY PROPERTIES. THE VICINITY PROPERTIES ARE CONTAMINATED PROPERTIES THAT ARE OUTSIDE THE QUARRY AND FOR WHICH THE US DEPARTMENT OF ENERGY IS RESPONSIBLE (E.G., THE FEMME OSAGE SLOUGH). COMPREHENSIVE RESPONSE ACTIONS FOR RESIDUAL MATERIALS, GROUNDWATER, AND VICINITY PROPERTIES CAN BE DEVELOPED ONLY AFTER THE BULK WASTES HAVE BEEN REMOVED FROM THE QUARRY SO THAT THE NATURE AND EXTENT OF RESIDUAL CONTAMINATION AND MIGRATION PATHWAYS CAN BE FULLY ASSESSED.

**Text:** Full-text ROD document follows on next page.

Text:

* REMOVAL OF THE BULK WASTES FROM THE QUARRY USING STANDARD EQUIPMENT AND PROCEDURES.

* TRANSPORTING THE BULK WASTES ALONG A DEDICATED HAUL ROAD TO THE CHEMICAL PLANT AREA OF THE WELDON SPRING SITE.



* PLACING THE BULK WASTES IN CONTROLLED STORAGE IN AN ENGINEERED TEMPORARY STORAGE FACILITY.

FOLLOWING REMOVAL OF THE WASTES, DETAILED STUDIES WILL BE MADE OF THE EMPTY QUARRY AND LOCAL GROUNDWATER SYSTEM. THESE STUDIES WILL FACILITATE DECISIONS WITH REGARD TO THE THREE REMAINING COMPONENTS OF THE QUARRY REMEDIAL ACTION, I.E., (1) RESIDUAL MATERIALS REMAINING IN THE QUARRY WALLS AND FISSURES, (2) GROUNDWATER, AND (3) VICINITY PROPERTIES. THE VICINITY PROPERTIES ARE CONTAMINATED PROPERTIES THAT ARE OUTSIDE THE QUARRY AND FOR WHICH THE US DEPARTMENT OF ENERGY IS RESPONSIBLE (E.G., THE FEMME OSAGE SLOUGH). COMPREHENSIVE RESPONSE ACTIONS FOR RESIDUAL MATERIALS, GROUNDWATER, AND VICINITY PROPERTIES CAN BE DEVELOPED ONLY AFTER THE BULK WASTES HAVE BEEN REMOVED FROM THE QUARRY SO THAT THE NATURE AND EXTENT OF RESIDUAL CONTAMINATION AND MIGRATION PATHWAYS CAN BE FULLY ASSESSED. THESE ACTIONS, WHICH WILL ADDRESS FINAL QUARRY CLEANUP CRITERIA, WILL BE DEVELOPED IN CONSULTATION WITH REGION VII OF THE US ENVIRONMENTAL PROTECTION AGENCY (EPA) AND THE STATE OF MISSOURI AND WILL BE DESCRIBED IN FUTURE DOCUMENTS.

DECLARATION

THE SELECTED REMEDY IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT; IT COMPLIES WITH FEDERAL AND STATE REQUIREMENTS THAT ARE LEGALLY APPLICABLE OR RELEVANT AND APPROPRIATE TO THE REMEDIAL ACTION, UNLESS THOSE REQUIREMENTS HAVE BEEN PROPERLY WAIVED IN ACCORDANCE WITH CERCLA; AND IT IS COST EFFECTIVE. THIS REMEDY UTILIZES PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE GIVEN THE LIMITED SCOPE OF THIS REMEDIAL ACTION. HOWEVER, BECAUSE THIS ACTION CONSTITUTES NEITHER THE FINAL REMEDY FOR THE QUARRY NOR THE FINAL DECISION FOR DISPOSITION OF THE BULK WASTES, IT DOES NOT SATISFY THE STATUTORY PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT OF THE REMEDY. POTENTIAL TREATMENT TECHNOLOGIES WILL BE CONSIDERED IN THE PROCESS FOR SELECTION OF THE FINAL REMEDY FOR THE QUARRY AND FOR FINAL DISPOSITION OF THE BULK WASTES.

BECAUSE THIS REMEDY MAY RESULT IN HAZARDOUS SUBSTANCES REMAINING ON SITE ABOVE HEALTH-BASED LEVELS, A REVIEW WILL BE CONDUCTED WITHIN FIVE YEARS AFTER COMMENCEMENT OF THIS REMEDIAL ACTION TO ENSURE THAT THE REMEDY CONTINUES TO PROVIDE ADEQUATE PROTECTION OF HUMAN HEALTH AND THE

ENVIRONMENT.

REGIONAL ADMINISTRATOR
US ENVIRONMENTAL PROTECTION AGENCY
REGION VII DATE: 09/28/90

#SNLD
SITE NAME, LOCATION, AND DESCRIPTION
1
Order number 940620-114010-ROD -001-001


THE WELDON SPRING SITE IS LOCATED IN ST. CHARLES COUNTY, MISSOURI, NEAR THE CITY OF WELDON SPRING, ABOUT 48 (30 MI) WEST OF ST. LOUIS (FIGURE 1). THE SITE CONSISTS OF TWO NONCONTIGUOUS AREAS: (1) THE CHEMICAL PLANT AREA AND (2) THE QUARRY. THE CHEMICAL PLANT AREA IS ABOUT 3.2 (2 MI) SOUTHWEST OF THE JUNCTION OF MISSOURI (STATE) ROUTE 94 AND US ROUTE 40/61. THE QUARRY IS ABOUT 6.4 KM (4 MI) SOUTH-SOUTHWEST OF THE CHEMICAL PLANT AREA AND ABOUT 8 KM (5 MI) SOUTHWEST OF THE TOWN OF WELDON SPRING. BOTH THE CHEMICAL PLANT AREA AND THE QUARRY ARE ACCESSIBLE FROM STATE ROUTE 94 AND ARE FENCED AND CLOSED TO THE PUBLIC. THE LOCATIONS OF THE CHEMICAL PLANT AREA AND THE QUARRY ARE SHOWN IN MORE DETAIL IN FIGURE 2.

THE CHEMICAL PLANT AREA COVERS ABOUT 88 HA (217 ACRES) AND CONTAINS VARIOUS BUILDINGS AND PONDS (INCLUDING FOUR RAFFINATE PITS) AS WELL AS GRAVEL AND PAVED SURFACES. VEGETATION IN THIS AREA IS PREDOMINANTLY GRASSES, SHRUBS, AND SMALL TREES. THE AUGUST A. BUSCH MEMORIAL WILDLIFE AREA IS LOCATED TO THE NORTH, THE WELDON SPRING WILDLIFE AREA TO THE SOUTH AND EAST, AND THE US ARMY RESERVE AND NATIONAL GUARD TRAINING AREA TO THE WEST.

THE QUARRY WAS EXCAVATED INTO A LIMESTONE BLUFF THAT FORMS A VALLEY WALL AT THE EDGE OF THE MISSOURI RIVER ALLUVIAL FLOODPLAIN. PRIOR TO 1942, IT WAS MINED FOR LIMESTONE TO SUPPORT VARIOUS CONSTRUCTION ACTIVITIES. THE QUARRY IS ABOUT 300 M (1,000 FT) LONG BY 140 M (450 FT) WIDE AND COVERS AN AREA OF APPROXIMATELY 3.6 HA (9 ACRES). THE MAIN FLOOR COMPRISES APPROXIMATELY 0.8 HA (2 ACRES) AND CURRENTLY CONTAINS ABOUT 11,000 M(3) (3,000,000 GAL) OF PONDED WATER COVERING ABOUT 0.2 HA (0.5 ACRE). THE QUARRY IS VEGETATED WITH GRASSES, SHRUBS, AND TREES, AND IS SURROUNDED BY THE WELDON SPRING WILDLIFE AREA. THE GENERAL LAYOUT IS SHOWN IN FIGURE 3.

THE MISSOURI-KANSAS-TEXAS RAILROAD LINE FORMERLY PASSED JUST SOUTH OF THE QUARRY. THIS LINE WAS RECENTLY DISMANTLED, AND THE RIGHT-OF-WAY HAS BEEN CONVERTED TO A GRAVEL-BASED PUBLIC TRAIL FOR HIKING AND BIKING (THE MISSOURI RIVER STATE TRAIL). A RAIL SPUR ENTERS THE QUARRY AT ITS LOWER LEVEL FROM THE WEST AND EXTENDS APPROXIMATELY ONE-THIRD OF ITS LENGTH. THE SPUR IS OVERGROWN WITH VEGETATION AND IS IN A STATE OF DISREPAIR. THE ST. CHARLES COUNTY WELL FIELD IS LOCATED TO THE SOUTHEAST BETWEEN THE QUARRY AND THE MISSOURI RIVER (FIGURE 4). THE NEAREST WELL IS

LOCATED ABOUTT 0.8 KM (0.5 MI) FROM THE QUARRY.

THE QUARRY AND THE CHEMICAL PLANT AREA ARE RELATED AS TO HISTORY AND PURPOSE, ARE REASONABLY CLOSE IN PROXIMITY, AND ARE COMPATIBLE WITH REGARD TO REMEDIATION APPROACH. THEREFORE, THEY ARE CONSIDERED ONE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA) SITE FOR PURPOSES OF THIS RESPONSE ACTION.

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SITE HISTORY

IN APRIL 1941, THE US DEPARTMENT OF THE ARMY ACQUIRED ABOUT 7,000 HA (17,000 ACRES) OF LAND IN ST. CHARLES COUNTY, MISSOURI, FOR CONSTRUCTION OF THE WELDON SPRING ORDNANCE WORKS. FROM NOVEMBER 1941 THROUGH JANUARY 1944, THE ATLAS POWDER COMPANY OPERATED THE ORDNANCE WORKS FOR THE ARMY TO PRODUCE TRINITROTOLUENE (TNT) AND DINITROTOLUENE (DNT) EXPLOSIVES. THE ORDNANCE WORKS WAS REOPENED DURING 1945 AND 1946 BUT WAS CLOSED AND DECLARED SURPLUS TO ARMY NEEDS IN APRIL 1946. BY 1949, ALL BUT ABOUT 810 HA (2,000 ACRES) HAD BEEN TRANSFERRED TO THE STATE OF MISSOURI (NOW THE AUGUST A. BUSCH MEMORIAL WILDLIFE AREA) AND THE UNIVERSITY OF MISSOURI (AS AGRICULTURAL LAND). MUCH OF THE LAND TRANSFERRED TO THE UNIVERSITY OF MISSOURI WAS SUBSEQUENTLY DEVELOPED INTO THE WELDON SPRING WILDLIFE AREA. EXCEPT FOR SEVERAL SMALL PARCELS TRANSFERRED TO ST. CHARLES COUNTY, THE REMAINING PROPERTY BECAME THE CURRENT CHEMICAL PLANT AREA AND ADJACENT US ARMY RESERVE AND NATIONAL GUARD TRAINING AREA.

THE US ATOMIC ENERGY COMMISSION (AEC), A PREDECESSOR OF THE US DEPARTMENT OF ENERGY (DOE), ACQUIRED 83 HA (205 ACRES) OF THE FORMER ORDNANCE WORKS PROPERTY FROM THE ARMY BY PERMIT IN MAY 1955, AND THE PROPERTY TRANSFER WAS APPROVED BY CONGRESS IN AUGUST 1956. AN ADDITIONAL 6 HA (15 ACRES) WAS LATER TRANSFERRED TO THE AEC FOR EXPANSION OF WASTE STORAGE CAPACITY. THE AEC CONSTRUCTED A FEED MATERIALS PLANT, NOW REFERRED TO AS THE CHEMICAL PLANT, ON THE PROPERTY FOR THE PURPOSE OF PROCESSING URANIUM AND THORIUM ORE CONCENTRATES. THE QUARRY, WHICH HAD BEEN USED BY THE ARMY SINCE THE EARLY 1940S FOR DISPOSAL OF CHEMICALLY CONTAMINATED MATERIALS, WAS TRANSFERRED TO THE AEC IN JULY 1960 FOR USE AS A DISPOSAL SITE FOR RADIOACTIVELY CONTAMINATED MATERIALS.

THE FEED MATERIALS PLANT WAS OPERATED FOR THE AEC BY THE URANIUM DIVISION OF MALLINCKRODT CHEMICAL WORKS FROM 1957 TO 1966. DURING THIS PERIOD, THE AEC USED THE QUARRY TO DISPOSE OF URANIUM AND THORIUM RESIDUES (DRUMMED AND UNCONTAINED), RADIOACTIVELY CONTAMINATED BUILDING RUBBLE AND PROCESS EQUIPMENT, AND TNT AND DNT RESIDUES FROM CLEANUP OF THE FORMER ORDNANCE WORKS. FOLLOWING CLOSURE BY THE AEC, THE ARMY REACQUIRED THE CHEMICAL PLANT SITE IN 1967 AND BEGAN CONVERTING THE FACILITY FOR HERBICIDE PRODUCTION. THE BUILDINGS WERE PARTIALLY DECONTAMINATED, AND SOME EQUIPMENT WAS DISMANTLED. CONTAMINATED RUBBLE AND EQUIPMENT FROM SOME BUILDINGS WERE PLACED IN THE QUARRY. IN 1969,

PRIOR TO BECOMING OPERATIONAL, THE HERBICIDE PROJECT WAS CANCELED. SINCE THAT TIME, THE PLANT HAS REMAINED ESSENTIALLY UNUSED AND IN CARETAKER STATUS.

IN 1971, THE ARMY RETURNED THE 21-HA (51-ACRE) PORTION OF THE PROPERTY CONTAINING THE RAFFINATE PITS TO THE AEC BUT RETAINED CONTROL OF THE REST OF THE CHEMICAL PLANT AREA. AS SUCCESSOR TO THE AEC, THE DOE ASSUMED RESPONSIBILITY FOR THE RAFFINATE PITS. IN 1984, THE ARMY REPAIRED SEVERAL OF THE BUILDINGS; DECONTAMINATED SOME OF THE FLOORS, WALLS, AND CEILINGS; AND REMOVED SOME CONTAMINATED EQUIPMENT TO AREAS



OUTSIDE OF THE BUILDINGS. IN MAY 1985, THE DOE DESIGNATED CONTROL AND DECONTAMINATION OF THE WELDON SPRING SITE AS A MAJOR FEDERAL PROJECT UNDER ITS SURPLUS FACILITIES MANAGEMENT PROGRAM. IN MAY 1988, THE DOE REDESIGNATED THE PROJECT AS A MAJOR SYSTEM ACQUISITION.

ON OCTOBER 1, 1985, CUSTODY OF THE ARMY PORTION OF THE CHEMICAL PLANT AREA WAS TRANSFERRED TO THE DOE. ON OCTOBER 15, 1985, THE US ENVIRONMENTAL PROTECTION AGENCY (EPA) PROPOSED TO INCLUDE THE WELDON SPRING QUARRY ON ITS NATIONAL PRIORITIES LIST (NPL); THIS LISTING OCCURRED ON JULY 22, 1987. ON JUNE 24, 1988, THE EPA PROPOSED TO EXPAND THE LISTING TO INCLUDE THE CHEMICAL PLANT AREA. THIS PROPOSAL WAS FINALIZED ON MARCH 13, 1989, AND THE EXPANDED SITE WAS PLACED ON THE NPL UNDER THE NAME "WELDON SPRING QUARRY/PLANT/PITS (USDOE/ARMY)." THE BALANCE OF THE FORMER WELDON SPRING ORDNANCE WORKS PROPERTY, WHICH IS ADJACENT TO THE DOE PORTION AND FOR WHICH THE ARMY HAS RESPONSIBILITY, WAS INCLUDED ON THE NPL AS A SEPARATE LISTING ON FEBRUARY 21, 1990, UNDER THE NAME "WELDON SPRING FORMER ARMY ORDNANCE WORKS."

A SUMMARY OF DISPOSAL ACTIVITIES AT THE QUARRY IS PRESENTED IN TABLE 1. BASED ON HISTORICAL DATA AND CHARACTERIZATION RESULTS, AN ESTIMATED 73,000 M(3) (95,000 YD(3)) OF CONTAMINATED MATERIALS IS PRESENT IN THE QUARRY; OF THIS, APPROXIMATELY 31,000 M(3) (40,000 YD(3)) IS RUBBLE, 39,000 M(3) (51,000 YD(3)) IS SOIL AND CLAY, AND 3,000 M(3) (4,000 YD(3)) IS POND SEDIMENT.

#HCP
HIGHLIGHTS OF COMMUNITY PARTICIPATION

A REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) WAS CONDUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF CERCLA, AS AMENDED, TO DOCUMENT THE PROPOSED MANAGEMENT OF THE QUARRY BULK WASTES AS A FOCUSED INTERIM REMEDIAL ACTION. DOCUMENTS DEVELOPED DURING THE RI/FS INCLUDED THE RI REPORT, A BASELINE RISK EVALUATION (BRE), AND AN FS REPORT THE RI/FS AND PROPOSED PLAN WERE RELEASED TO THE PUBLIC ON MARCH 5, 1990. AN INFORMATIONAL BULLETIN WAS ALSO PREPARED TO SUMMARIZE THIS PROPOSED ACTION AND FACILITATE THE COMMUNITY PARTICIPATION PROCESS.

THESE DOCUMENTS, ALONG WITH OTHER DOCUMENTS IN THE ADMINISTRATIVE RECORD FILE, HAVE BEEN MADE AVAILABLE TO THE PUBLIC IN THE PUBLIC READING ROOM

AT THE WELDON SPRING SITE. COPIES OF THESE DOCUMENTS HAVE ALSO BEEN PROVIDED AT FIVE ADDITIONAL INFORMATION REPOSITORIES AT THE FOLLOWING LOCATIONS: THE MEMORIAL ARTS BUILDING AT LINDENWOOD COLLEGE (ST. CHARLES, MISSOURI), KATHRYN M. LINNEMAN BRANCH OF THE ST. CHARLES CITY/COUNTY LIBRARY (ST. CHARLES, MISSOURI), SPENCER CREEK BRANCH OF THE ST. CHARLES CITY/COUNTY LIBRARY (ST. PETERS,MISSOURI), AND FRANCIS HOWELL HIGH SCHOOL (ST. CHARLES, MISSOURI). A NOTICE OF AVAILABILITY OF THESE DOCUMENTS WAS PUBLISHED IN THE ST. CHARLES JOURNAL ON MARCH 4, 1990, AND THE ST. CHARLES SECTION OF THE ST. LOUIS POST DISPATCH ON MARCH 28, 1990.



A PUBLIC COMMENT PERIOD WAS HELD FROM MARCH 5, 1990, THROUGH APRIL 9, 1990. A PUBLIC MEETING WAS HELD ON MARCH 29, 1990, AT THE RAMADA INN IN WENTZILLE, MISSOURI, AS A PART OF THE PUBLIC PARTICIPATION PROCESS. THIS PUBLIC MEETING WAS ADVERTISED IN THE TWO NEWSPAPER ANNOUNCEMENTS DESCRIBED ABOVE. AT THIS MEETING, REPRESENTATIVES FROM THE DOE, EPA REGION VII, AND THE STATE OF MISSOURI ANSWERED QUESTIONS ABOUT THE SITE AND THE REMEDIAL ALTERNATIVES UNDER CONSIDERATION FOR THE QUARRY BULK WASTES. TRANSCRIPTS OF THE MEETING ARE INCLUDED AS PART OF THE ADMINISTRATIVE RECORD FILE FOR THIS OPERABLE UNIT REMEDIAL ACTION. THE ADMINISTRATIVE RECORD FILE INCLUDES THE INFORMATION USED TO SUPPORT THE SELECTED REMEDY. DOCUMENTS IN THE ADMINISTRATIVE RECORD INCLUDE THE RI, BRE, AND FS REPORTS.

IN ADDITION TO THE PUBLIC MEETING, THE DOE HELD NUMEROUS BRIEFINGS AND MEETINGS WITH PUBLIC OFFICIALS, SCHOOL ADMINISTRATORS, SPECIAL INTEREST GROUPS, AND MEMBERS OF THE GENERAL PUBLIC. THESE MEETINGS, WHICH WERE GENERALLY INFORMAL, ALLOWED FOR AN EFFECTIVE EXCHANGE OF INFORMATION AND RECEIPT OF PUBLIC INPUT. A RESPONSE TO THE COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD IS INCLUDED IN A RESPONSIVENESS SUMMARY, WHICH WAS PREPARED AS A SEPARATE DOCUMENT. A SUMMARY OF THE MAJOR ISSUES RAISED DURING THE PUBLIC COMMENT PERIOD IS PROVIDED IN THIS RECORD OF DECISION. THIS DECISION DOCUMENT PRESENTS THE SELECTED REMEDIAL ACTION FOR MANAGEMENT OF THE BULK WASTES AT THE WELDON SPRING QUARRY IN ACCORDANCE WITH CERCLA, AS AMENDED, AND TO THE MAXIMUM EXTENT PRACTICABLE, THE NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN (NCP). THE DECISION FOR THIS SITE IS BASED ON THE ADMINISTRATIVE RECORD.

#SROU
SCOPE AND ROLE OF OPERABLE UNIT

THE DOE IS ADDRESSING THE QUARRY BULK WASTES AS AN OPERABLE UNIT REMEDIAL ACTION (OURA) AS PART OF THE OVERALL REMEDIAL ACTION PLANNED FOR THE WELDON SPRING SITE. THE TWO GENERAL TYPES OF REMEDIAL ACTIONS THAT CAN BE ADDRESSED AS OURAS ARE (1) FINAL ACTIONS THAT COMPLETELY REMEDIATE A DISCRETE AREA OF A SITE OR (2) INTERIM ACTIONS TAKEN TO FACILITATE CLEANUP AND TO MITIGATE AN ONGOING RELEASE OR THREAT OF A RELEASE OR TO LIMIT A POTENTIAL PATHWAY OF EXPOSURE. REMEDIAL ACTION FOR THE QUARRY BULK WASTES FALLS INTO THE SECOND CATEGORY. THE

IMPLEMENTATION OF A RESPONSE ACTION AS AN OURA MUST BE CONSISTENT WITH THE PERMANENT REMEDY FOR THE ENTIRE SITE, EVEN THOUGH THE ACTION MIGHT BE IMPLEMENTED PRIOR TO SELECTION OF THE FINAL REMEDY.

DEFINING THE QUARRY BULK WASTES AS AN OURA OF THE WELDON SPRING SITE MAKES IT POSSIBLE TO EXPEDITE MANAGEMENT OF THESE WASTES. THIS ACTION DOES NOT ADDRESS FINAL DISPOSAL OF THE QUARRY BULK WASTES. AS DISCUSSED IN MORE DETAIL BELOW, THAT DECISION WILL BE MADE AS PART OF A SUBSEQUENT REMEDY SELECTION PROCESS FOR THE CHEMICAL PLANT AREA.



QUARRY BULK WASTES ARE DEFINED AS THE CHEMICALLY AND RADIOACTIVELY CONTAMINATED SOLIDS PRESENT IN THE QUARRY THAT CAN BE REMOVED USING STANDARD EQUIPMENT AND TECHNIQUES. THE TOTAL VOLUME OF THESE WASTES --WHICH CONSIST PRIMARILY OF SOILS, SLUDGES, EQUIPMENT, AND STRUCTURAL DEBRIS--IS ABOUT 73,000 M(3) (95,000 YD(3)).

THIS OURA FOR THE QUARRY BULK WASTES IS ONE OF SEVERAL COMPONENTS FOR OVERALL REMEDIATION OF THE WELDON SPRING SITE. AN OVERVIEW OF THE ENVIRONMENTAL STRATEGY FOR ACHIEVING OVERALL SITE REMEDIATION IS PRESENTED IN FIGURE 5. REMEDIAL ACTION ALTERNATIVES FOR THE CHEMICAL PLANT AREA WILL BE EVALUATED IN A SEPARATE RI/FS. THIS RI/FS WILL BE MODIFIED TO INCORPORATE THE REQUIREMENTS OF AN ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR COMPLIANCE WITH THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA). THIS INTEGRATED PROCESS IS BEING REFERRED TO AS AN RI/FS-EIS.

AS DEPICTED IN FIGURE 5, VARIOUS INTERIM ACTIONS (BOTH REMOVAL ACTIONS AND OPERABLE UNIT REMEDIAL ACTIONS) WILL BE PERFORMED PRIOR TO COMPLETION OF THIS RI/FS-EIS IN ORDER TO MITIGATE ACTUAL OR POTENTIAL RELEASES OF RADIOACTIVE OR CHEMICAL CONTAMINANTS INTO THE ENVIRONMENT. DISPOSAL DECISIONS WILL BE MADE AS PART OF THE REMEDIAL ACTION DECISION FOR THE CHEMICAL PLANT AREA AND WILL BE ADDRESSED IN THE RI/FS-EIS THAT IS CURRENTLY IN PREPARATION.

MANAGEMENT OF THE BULK WASTES IS ONE OF FIVE SEPARATE COMPONENTS OF THE OVERALL ENVIRONMENTAL RESPONSE UNDER CONSIDERATION FOR THE QUARRY (FIGURE 6). THE FIVE COMPONENTS ARE (1) SURFACE WATER, WHICH PROVIDES THE HYDRAULIC GRADIENT FOR CONTAMINANT MIGRATION TO GROUNDWATER; (2) BULK WASTES, WHICH CONSTITUTE THE SOURCE OF CONTAMINANTS MIGRATING INTO THE AIR AND UNDERLYING GROUNDWATER AT THE QUARRY; (3) MATERIALS REMAINING IN THE QUARRY WALLS AND FLOOR AFTER BULK WASTE REMOVAL (I.E., RESIDUALS); (4) GROUNDWATER; AND (5) VICINITY PROPERTIES, WHICH ARE CONTAMINATED PROPERTIES OUTSIDE THE QUARRY FOR WHICH THE DOE IS RESPONSIBLE (E.G., THE FEMME OSAGE SLOUGH).

IN RESPONSE TO A POTENTIAL THREAT TO THE NEARBY ST. CHARLES COUNTY ALLUVIAL WELL FIELD, MANAGEMENT OF CONTAMINATED SURFACE WATER IS THE FIRST OF THESE FIVE COMPONENTS BEING ADDRESSED. THIS WELL FIELD SUPPLIES DRINKING WATER TO MORE THAN 60,000 RESIDENTS OF ST. CHARLES COUNTY. IT IS LOCATED WITHIN 1.6 KM (1 MI) OF THE QUARRY. THE QUARRY

POND IS PROVIDING A HYDRAULIC GRADIENT FOR CONTAMINANT MIGRATION INTO THE LOCAL GROUNDWATER BECAUSE THE POND SURFACE IS HIGHER THAN THE NEARBY GROUNDWATER TABLE.

THE EXPEDITED RESPONSE ACTION FOR THIS COMPONENT HAS BEEN DOCUMENTED IN AN ENGINEERING EVALUATION/COST ANALYSIS (EE/CA) REPORT. THE ALTERNATIVE SELECTED AS A RESULT OF THE EE/CA PROCESS, WHICH INCLUDED PUBLIC REVIEW AND COMMENT, WAS TO TREAT THE PONDED WATER IN A FACILITY CONSTRUCTED ADJACENT TO THE QUARRY AND RELEASE THE TREATED WATER TO THE MISSOURI RIVER IN COMPLIANCE WITH A PERMIT ISSUED TO THE DOE BY THE MISSOURI



DEPARTMENT OF NATURAL RESOURCES. THE ACTION IS EXPECTED TO BE INITIATED IN 1991 AND WILL CONTINUE UNTIL SUBSEQUENT DECISIONS ARE IMPLEMENTED FOR A PERMANENT SOLUTION AT THE QUARRY.

THE PURPOSE OF THE QUARRY BULK WASTE OURA IS TO MINIMIZE THE POTENTIAL FOR FURTHER MIGRATION OF CONTAMINANTS FROM THE QUARRY INTO THE ENVIRONMENT AND TO FACILITATE OVERALL SITE CLEANUP BY MAKING IT POSSIBLE TO ASSESS THE EXTENT OF RESIDUAL CONTAMINATION IN THE QUARRY AND IDENTIFY PATHWAYS FOR MIGRATION OF CONTAMINANTS FROM THE QUARRY. THE BULK WASTES CONSTITUTE THE SOURCE OF CONTAMINANTS THAT ARE BEING RELEASED INTO THE AIR AT THE QUARRY AND WHICH ARE MIGRATING THROUGH THE FRACTURED WALLS AND FLOOR OF THE QUARRY INTO THE UNDERLYING GROUND WATER.

THE COMPREHENSIVE RESPONSE ACTIONS FOR RESIDUAL MATERIALS, GROUNDWATER, AND VICINITY PROPERTIES CAN BE DEVELOPED ONLY AFTER THE BULK WASTES ARE REMOVED FROM THE QUARRY SO THAT THE NATURE AND EXTENT OF RESIDUAL CONTAMINATION AND MIGRATION PATHWAYS CAN BE FULLY ASSESSED. THESE ACTIONS, WHICH WILL ADDRESS FINAL QUARRY CLEANUP CRITERIA, WILL BE DEVELOPED IN CONSULTATION WITH EPA REGION VII AND THE STATE OF MISSOURI AND WILL BE DESCRIBED IN FUTURE DOCUMENTS ON THE QUARRY.

#SC
SITE CHARACTERISTICS

SETTING

THE WELDON SPRING QUARRY IS SITUATED IN A RELATIVELY REMOTE LOCATION ALONG MISSOURI STATE ROUTE 94 ABOUT 6.4 KM (4 MI) SOUTH-SOUTHWEST OF THE CHEMICAL PLANT AREA AND ABOUT 8 KM (5 MI) SOUTHWEST OF THE CITY OF WELDON SPRING. THE QUARRY IS SURROUNDED BY THE WELDON SPRING WILDLIFE AREA, WHICH IS MANAGED BY THE MISSOURI DEPARTMENT OF CONSERVATION AND IS OPEN THROUGHOUT THE YEAR TO THE GENERAL PUBLIC FOR A VARIETY OF RECREATIONAL USES. THIS WILDLIFE AREA IS LARGELY UNDISTURBED, HEAVILY WOODED, AND CONTAINS REGIONS OF HEAVY UNDERBRUSH. VEGETATION AT THE QUARRY CONSISTS PRIMARILY OF GRASSES, SHRUBS, AND TREES. AGRICULTURAL CROPS ARE GROWN ON MUCH OF THE LAND SOUTH OF THE QUARRY. ACCESS TO THE QUARRY IS RESTRICTED BY A 2.1-M (7-FT) HIGH CHAIN LINK FENCE WHICH IS TOPPED BY THREE STRANDS OF BARBED WIRE. THIS FENCE COMPLETELY SURROUNDS

THE QUARRY.

THE QUARRY WAS EXCAVATED INTO A LIMESTONE BLUFF OF THE KIMMSWICK LIMESTONE FORMATION THAT FORMS A VALLEY WALL AT THE EDGE OF THE MISSOURI RIVER FLOODPLAIN; THIS LIMESTONE FORMATION CONTAINS NUMEROUS CRACKS AND FISSURES. THE QUARRY IS ABOUT 300 M (1,000 FT) LONG BY 140 M (450 FT) WIDE AND COVERS AN AREA OF APPROXIMATELY 3.6 HA (9 ACRES). THE MAIN FLOOR OF THE QUARRY COMPRISES APPROXIMATELY 0.8 HA (2 ACRES) AND CURRENTLY CONTAINS ABOUT 11,000 M(3) (3,000,000 GAL) OF PONDED WATER COVERING ABOUT 0.2 HA (0.5 ACRE). THE MISSOURI RIVER IS LOCATED



APPROXIMATELY 1.6 KM (1 MI) TO THE SOUTHEAST. NEARBY STREAMS INCLUDE LITTLE FEMME OSAGE CREEK TO THE WEST, AN UNNAMED TRIBUTARY OF LITTLE FEMME OSAGE CREEK TO THE NORTH, AND FEMME OSAGE CREEK TO THE SOUTHWEST. THE FEMME OSAGE SLOUGH IS LOCATED ABOUT 210 M (700 FT) SOUTH OF THE QUARRY (FIGURE 4).

THE QUARRY BORDERS THE MISSOURI RIVER ALLUVIAL FLOODPLAIN. THE SURROUNDING TOPOGRAPHY, EXCEPT FOR THE FLOODPLAIN AREA TO THE SOUTH, IS RUGGED, HEAVILY WOODED, AND CHARACTERIZED BY DEEP RAVINES. THE SURFACE ELEVATION OF WASTE IN THE QUARRY IS ABOUT 145 M (480 FT), AND THE ELEVATION OF THE QUARRY RIM IS ABOUT 170 M (550 FT) MEAN SEA LEVEL (MSL). THE AVERAGE SURFACE ELEVATION OF THE WATER PONDED IN THE QUARRY IS ABOUT 142 M (465 FT) MSL. A PYRAMID-SHAPED LIMESTONE HILL RISES FROM THE QUARRY FLOOR TO AN ELEVATION OF ABOUT 158 M (518 FT) MSL. THE UPPER ELEVATIONS AT THE QUARRY ARE WELL ABOVE THE MISSOURI RIVER FLOODPLAIN. THE QUARRY WAS ORIGINALLY EXCAVATED TO A BOTTOM ELEVATION OF APPROXIMATELY 136 M (446 FT) MSL.

THE PONDED QUARRY WATER IS HYDRAULICALLY CONNECTED TO THE LOCAL GROUNDWATER SYSTEM IN THE UNDERLYING FRACTURED BEDROCK, AND ITS ELEVATION APPEARS TO BE A HYDROLOGICALLY HIGH ELEVATION FOR THE VICINITY. MOST OF THE GROUNDWATER FLOW FROM THE QUARRY IS TRANSPORTED BY THE LOCAL GRADIENT TOWARD THE ALLUVIUM OF THE MISSOURI RIVER FLOODPLAIN. THE CONNECTION BETWEEN THE FRACTURED LIMESTONE AQUIFER BENEATH THE QUARRY AND THE UNCONFINED ALLUVIAL AQUIFER NEAR FEMME OSAGE SLOUGH IS NOT CLEARLY UNDERSTOOD. ALTHOUGH IT IS CERTAIN THAT GROUNDWATER FLOWS TOWARD THE MISSOURI RIVER FROM THE QUARRY, THE INFLUENCE OF FEMME OSAGE SLOUGH ON THIS FLOW AND THE ASSOCIATED SOLUTE TRANSPORT IS UNCERTAIN. IT APPEARS THAT THE CLAY AND SILTY ALLUVIUM AT THE SLOUGH MAY ACT AS A GROUNDWATER BARRIER. ALTHOUGH AT PRESENT THERE IS NO EVIDENCE OF GROUNDWATER FLOW THROUGH THE ALLUVIAL MATERIAL BELOW THE SLOUGH TO THE ALLUVIAL AQUIFER, THE EXISTING GROUNDWATER MONITORING SYSTEM WILL BE EXPANDED. GROUNDWATER VELOCITY IN THE BEDROCK BELOW THE ALLUVIUM IS NOT KNOWN.

THE ST. CHARLES COUNTY WELL FIELD LIES BETWEEN THE QUARRY AND THE MISSOURI RIVER; IT IS SEPARATED FROM THE QUARRY BY THE FEMME OSAGE SLOUGH (FIGURE 4). MONITORING WELLS LOCATED BETWEEN THE QUARRY AND THE WELL FIELD ARE SAMPLED ROUTINELY IN ORDER TO MONITOR FOR BOTH CHEMICAL AND RADIOLOGICAL CONTAMINANTS. GROUNDWATER IN THE UNCONFINED ALLUVIAL

AQUIFER SOUTH OF FEMME OSAGE SLOUGH IS NOT RADIOACTIVELY CONTAMINATED; CONCENTRATIONS OF RADIOACTIVE CONSTITUENTS IN SAMPLES FROM THIS AQUIFER ARE WITHIN THE TYPICAL BACKGROUND RANGE FOR THIS REGION. HOWEVER, NITROAROMATIC COMPOUNDS HAVE BEEN DETECTED AT LOW LEVELS (LESS THAN 1 UG/L) IN GROUNDWATER SOUTH OF THE SLOUGH. THESE COMPOUNDS HAVE BEEN DETECTED SPORADICALLY IN 5 OF THE 10 DOE MONITORING WELLS LOCATED SOUTH OF THE SLOUGH.

NITROAROMATIC COMPOUNDS HAVE NOT MIGRATED TO THE COUNTY WELL FIELD. NITROAROMATIC COMPOUNDS DETECTED SOUTH OF THE SLOUGH MAY BE THE RESULT



OF CONTAMINATION IN SLOUGH SEDIMENTS DUE TO DISCHARGES OF NITROAROMATICALLY CONTAMINATED WASTES INTO LITTLE FEMME OSAGE CREEK DURING WORLD WAR II, PAST PUMPING TESTS ON THE QUARRY POND IN WHICH POND WATER WAS DISCHARGED DIRECTLY INTO LITTLE FEMME OSAGE CREEK, OR TRANSPORT VIA THE GROUNDWATER PATHWAY. (FEMME OSAGE SLOUGH WAS FORMERLY A PORTION OF FEMME OSAGE CREEK AND RECEIVED WATER FROM LITTLE FEMME OSAGE CREEK PRIOR TO DISCHARGE TO THE MISSOURI RIVER.)

THE ALLUVIAL AQUIFER SOUTH OF FEMME OSAGE SLOUGH APPEARS NOT TO BE CONTAMINATED WITH URANIUM. MONITORING WILL BE EXPANDED TO ESTABLISH SOLUTE CONCENTRATIONS AND GROUNDWATER FLOW DIRECTIONS IN THE DEEPER BEDROCK AQUIFER.

WASTE CHARACTERISTICS

THE MATERIALS DISPOSED OF IN THE QUARRY CONSIST OF WASTES FROM THE CHEMICAL PLANT AS WELL AS WASTES BROUGHT IN FROM OTHER AREAS IN THE PAST, INCLUDING (1) MATERIALS ASSOCIATED WITH THE PROCESSING OF URANIUM AND THORIUM CONCENTRATES, (2) URANIUM- AND RADIUM-CONTAMINATED RUBBLE, (3) HIGH-THORIUM-CONTENT MATERIALS (MOST OF WHICH WERE SUBSEQUENTLY REMOVED FROM THE QUARRY FOR THE PURPOSE OF RECOVERING RARE EARTH ELEMENTS), AND (4) 3.0 PERCENT THORIUM RESIDUES. MOST OF THE ESTIMATED 73,000 M(3) (95,000 YD(3)) OF BULK WASTES IN THE QUARRY IS RADIOACTIVELY CONTAMINATED. THE RADIOACTIVE CONTAMINANTS OF CONCERN ARE THOSE ASSOCIATED WITH THE URANIUM-238 AND THORIUM-232 DECAY SERIES (FIGURES 7 AND 8).

RADIOACTIVE CONTAMINATION ON THE MAIN FLOOR OF THE QUARRY COVERS AN AREA OF ALMOST 5,600 M(2) (60,000 FT(2)) AND EXTENDS TO DEPTHS OF ABOUT 12 M (40 FT); RADIOACTIVE CONTAMINATION IN THE ENTIRE QUARRY COVERS AN AREA OF ABOUT 15,900 M(2) (171,000 FT(2)) AND EXTENDS TO AN AVERAGE DEPTH OF ABOUT 4 M (13 FT). THE LOCATIONS AND DEPTHS OF RADIOACTIVE CONTAMINATION AT THE QUARRY ARE SHOWN IN FIGURES 9 AND 10. THE CONCENTRATIONS OF THE MAJOR RADIONUCLIDES IN THE QUARRY WASTES ARE SUMMARIZED IN TABLE 2.

IN EACH OF THE URANIUM-238 AND THORIUM-232 DECAY SERIES, ONE MEMBER OF THE SERIES IS A GAS (RADON-222 AND RADON-220, RESPECTIVELY). ELEVATED CONCENTRATIONS OF RADON-222 AND RADON-220 AND THEIR SHORT-LIVED DECAY PRODUCTS HAVE BEEN MEASURED IN THE ATMOSPHERE WITHIN THE QUARRY AND AT

THE QUARRY FENCE. THE AVERAGE CONCENTRATION OF RADON GAS (RADON-222 AND RADON-220) IN THE ATMOSPHERE WITHIN THE QUARRY IS 14 PCI/L BASED ON PREVIOUS MEASUREMENTS. THE ANNUAL AVERAGE CONCENTRATION AT THE FENCE LINE VARIES FROM YEAR TO YEAR AND HAS AVERAGED ABOUT 2 PCI/L OVER THE PAST FEW YEARS. THE BACKGROUND CONCENTRATION OF RADON GAS IN THE WELDON SPRING AREA IS ABOUT 0.3 PCI/L.

AS RADIONUCLIDES DECAY, THEY EMIT VARIOUS TYPES OF RADIATION; CERTAIN OF THESE CAN TRAVERSE ENVIRONMENTAL MEDIA AND PENETRATE HUMAN SKIN. HENCE, CLOSE PROXIMITY TO RADIOACTIVE MATERIALS CAN POSE HAZARDS TO INDIVIDUALS



WITHOUT ACTUAL UPTAKE BY THE BODY (I.E., THROUGH INGESTION OR INHALATION). THE MOST ENERGETIC FORM OF ELECTROMAGNETIC RADIATION EMITTED BY RADIONUCLIDES IS THE GAMMA RAY. ELEVATED GAMMA EXPOSURE RATES HAVE BEEN MEASURED AT THE QUARRY FENCE AND WITHIN THE QUARRY. THE HIGHEST MEASURED GAMMA EXPOSURE RATE AT THE QUARRY FENCE IS ABOUT 8 UR/HR ABOVE BACKGROUND; THE BACKGROUND GAMMA EXPOSURE RATE IN THE WELDON SPRING AREA IS ABOUT 10 UR/HR. THE GAMMA EXPOSURE RATE WITHIN THE QUARRY AVERAGES 60 UR/HR; THE MAXIMUM MEASURED RATE IS 625 UR/HR.

NONRADIOACTIVE CONTAMINANTS IN THE QUARRY BULK WASTES ARE CONSISTENT WITH THOSE EXPECTED FROM THE DISPOSAL HISTORY. BOTH THE TYPE OF WASTE MATERIAL PRESENT AND THE CONTAMINANT CONCENTRATIONS IN THIS MATERIAL ARE HIGHLY VARIABLE. AS PART OF THE RADIOLOGICAL CHARACTERIZATION CONDUCTED IN 1984 AND 1985, ONE SURFACE AND SIX SUBSURFACE SAMPLES WERE COLLECTED FOR NONRADIOLOGICAL ANALYSIS. THESE SAMPLES WERE ANALYZED FOR PRIORITY POLLUTANT METALS, ORGANIC COMPOUNDS, CYANIDE, AND OTHER SELECTED COMPOUNDS. SOME ORGANIC CONTAMINANTS AND ELEVATED LEVELS OF SOME METALS, ORGANIC CONTAMINANTS AND ELEVATED LEVELS OF SOME METALS WERE DETECTED. RESULTS FOR CONTAMINANTS THAT WERE MEASURED ABOVE DETECTION LIMITS ARE SUMMARIZED IN TABLE 3.

A MORE EXTENSIVE CHEMICAL CHARACTERIZATION STUDY WAS CONDUCTED AT THE QUARRY IN 1986 WHEN SAMPLES WERE TAKEN FROM 17 BOREHOLES. THE DEPTHS OF THE BOREHOLES WERE HIGHLY VARIABLE, RANGING FROM 0.61 M (2 FT) TO 12 M (40 FT). THE BOREHOLE LOCATIONS WERE SELECTED ON THE BASIS OF HISTORICAL DATA ON WASTE DISPOSAL AT THE QUARRY.

NITROAROMATIC COMPOUNDS, POLYCHLORINATED BIPHENYLS (PCBS), AND POLYNUCLEAR AROMATIC HYDROCARBONS (PAHS) WERE DETECTED IN THESE SAMPLES. THE RESULTS OF THIS STUDY ARE SUMMARIZED IN TABLE 4. BECAUSE OF THE HETEROGENEOUS NATURE OF THE WASTES AND THE LIMITED NUMBER OF SAMPLES TAKEN, THE RESULTS ARE EXPECTED TO BE INDICATIVE OF, RATHER THAN REPRESENTATIVE OF, THE WASTES PRESENT IN THE QUARRY.

THREE SURFACE SAMPLES WERE COLLECTED IN MAY 1987 FROM AN AREA IN THE NORTHEASTERN CORNER OF THE QUARRY WHERE SURFICIAL DISCOLORATION SUGGESTED THE PRESENCE OF NITROAROMATIC COMPOUNDS. VARIOUS NITROAROMATIC COMPOUNDS WERE DETECTED IN THE SAMPLES. THE COMPOUND 2,4,6-TNT WAS DETECTED AT AN AVERAGE CONCENTRATION OF 13,000 UG/KG. THE RESULTS OF THE ANALYSES FOR NITROAROMATIC COMPOUNDS ARE SUMMARIZED IN

TABLE 5.

THESE CHARACTERIZATION RESULTS INDICATE THAT CHEMICAL CONTAMINATION IS PRESENT THROUGHOUT MUCH OF THE QUARRY BULK WASTES AND THAT THE DISTRIBUTION OF THE CONTAMINANTS IS HIGHLY HETEROGENEOUS. HOWEVER, GENERAL LOCATIONS OF VARIOUS WASTE TYPES CAN BE DEFINED IN SOME CASES. FOR EXAMPLE, NITROAROMATIC COMPOUNDS ARE FOUND IN THE EASTERN END OF THE QUARRY, WHICH IS CONSISTENT WITH THE DISPOSAL HISTORY. THE PCBS DO NOT SHOW A DEFINED PATTERN OF DISTRIBUTION BUT ARE TYPICALLY LIMITED TO NEAR-SURFACE DEPTHS (0 TO 1.8 M (0 TO 6 FT)). MOST CHEMICAL



CONTAMINANTS ARE FOUND AT DEPTHS OF LESS THAN 3.6 M (12 FT).

#SSR
SUMMARY OF SITE RISKS

A BASELINE RISK EVALUATION WAS PREPARED TO ASSESS THE POTENTIAL RISKS ASSOCIATED WITH THE CONTAMINATION PRESENT AT THE QUARRY. RISK ASSESSMENT IS A KEY COMPONENT OF THE RI/FS PROCESS AND IS TYPICALLY CONDUCTED FOR THE BASELINE (NO-ACTION) CASE TO (1) DETERMINE POTENTIAL IMPACTS TO HUMAN HEALTH AND THE ENVIRONMENT, (2) SUPPORT THE DETERMINATION OF APPROPRIATE CLEANUP CRITERIA, AND (3) PROVIDES A BASIS FOR EVALUATING THE EFFECTIVENESS OF PROPOSED REMEDIAL ACTION ALTERNATIVES. HOWEVER, BECAUSE MANAGEMENT OF THE BULK WASTES IS A FOCUSED INTERIM ACTION OF THE OVERALL REMEDIAL ACTION FOR THE QUARRY, THE SCOPE AND PURPOSE OF THIS ASSESSMENT WAS LESS COMPREHENSIVE THAN THAT GENERALLY PERFORMED IN A BASELINE RISK ASSESSMENT. BECAUSE SITE CHARACTERIZATION DATA ON THE NATURE AND EXTENT OF THE CONTAMINATION AND THE PATHWAYS AND MECHANISMS FOR CONTAMINANT MIGRATION FROM THE QUARRY IS LIMITED, A COMPREHENSIVE BASELINE RISK ASSESSMENT COULD NOT BE PREPARED. FOR THIS REASON, THE ASSESSMENT WAS REFERRED TO AS A BASELINE RISK "EVALUATION," TO DISTINGUISH IT FROM THE MORE COMPREHENSIVE BASELINE RISK "ASSESSMENT." THE ANALYSES IN THIS RISK EVALUATION WERE CARRIED OUT TO MEET, WITHIN THE LIMITS OF AVAILABLE DATA, THE FIRST OF THE THREE OBJECTIVES OF A RISK ASSESSMENT, I.E., TO ASSESS THE POTENTIAL IMPACTS ON HUMAN HEALTH AND THE ENVIRONMENT. THE SCOPE OF THE EVALUATION WAS LIMITED TO AN ASSESSMENT OF THE POTENTIAL RISKS ASSOCIATED WITH THE BULK WASTES. IT ADDRESSED EXPOSURES THAT COULD OCCUR IN THE SHORT TERM UNDER EXISTING SITE CONDITIONS. RISKS WILL BE ASSESSED FURTHER AS PART OF OTHER RI/FS PROCESSES BEFORE THE WASTES ARE FINALLY DISPOSED OF AND THE OVERALL REMEDIATION OF THE QUARRY IS COMPLETED.

CONTAMINANT IDENTIFICATION

THE BRE IDENTIFIED THOSE RADIONUCLIDES AND CHEMICALS PRESENT IN THE QUARRY BULK WASTES THAT POSE THE GREATEST POTENTIAL RISK TO HUMAN HEALTH. THE RADIOACTIVE CONTAMINANTS OF CONCERN (I.E., INDICATOR ADIONUCLIDES) ARE THOSE ASSOCIATED WITH THE URANIUM-238 AND THORIUM-232 DECAY SERIES (SEE TABLE 2 AND FIGURE 7 AND 8). THE RADIOLOGICAL HAZARDS OF THE VARIOUS RADIONUCLIDES IN THESE SERIES WERE

DETERMINED FROM THE ACTIVITY CONCENTRATIONS OF URANIUM-238, THORIUM-232, THORIUM-230, RADIUM-226 AND FROM MEASURED VALUES OF RADON-222, RADON-220, AND THEIR SHORT-LIVED DECAY PRODUCTS. THE RISKS ASSOCIATED WITH GAMMA RADIATION WERE ALSO ASSESSED.

THE INDICATOR CHEMICAL WERE SELECTED FROM CONTAMINANTS DETECTED IN THE WASTES (SEE TABLES 2,3,4,AND 5). THEY WERE SELECTED MAINLY ON THE BASIS OF THEIR TOXICOLOGICAL PROPERTIES AND THEIR CONCENTRATIONS IN SURFACE SOILS AT THE QUARRY. (UNDER CURRENT SITE CONDITIONS, THE ONLY COMPLETE EXPOSURE PATHWAYS AT THE QUARRY RESULT FROM SURFACE SOIL CONTAMINATION.)



THE INDICATOR CONTAMINANTS FOR THE BRE WERE NITROAROMATIC COMPOUNDS (2,4,6-TNT, 2,4-DNT, 2,6-DNT, AND 1,3,5-TRINITROBENZENE), METALS (ARSENIC, LEAD, NICKEL, SELENIUM, AND URANIUM), PCBS, AND PAHS. OF THESE CONTAMINANTS, TNT, DNT, ARSENIC, LEAD, NICKEL, PCBS, AND PAHS ARE CONSIDERED TO BE POTENTIAL CARCINOGENS.

EXPOSURE ASSESSMENT

THE KEY FACTORS CONSIDERED IN DEVELOPING THE EXPOSURE PATHWAYS AT THE QUARRY INCLUDE (1) THE QUARRY IS FENCED, CLOSED TO THE PUBLIC, AND SURROUNDED BY WILDLIFE AREAS; (2) THE NEAREST RESIDENCE IS 0.8 KM (0.5 MI) WEST OF THE QUARRY ON STATE ROUTE 94; AND (3) NO REMEDIAL ACTION ACTIVITIES ARE CURRENTLY TAKING PLACE AT THE QUARRY. THE EXPOSURE ASSESSMENT IN THE BRE WAS ON CURRENT LAND-USE CONDITIONS AND CONTAMINANT CONCENTRATIONS.

THE MAIN SOURCE OF CONTAMINATION WITHIN THE QUARRY IS THE BULK WASTES, AND THE EXPOSURE PATHWAYS CONSIDERED IN THE RISK EVALUATION ARE THOSE DIRECTLY ASSOCIATED WITH THESE WASTES. IT HAS BEEN SHOWN THAT THE GROUNDWATER AT THE QUARRY CONTAINS ELEVATED CONCENTRATIONS OF CHEMICAL AND RADIOACTIVE CONTAMINANTS, BUT THIS WATER IS NOT A DRINKING WATER SOURCE. THE GROUNDWATER SOUTH OF THE QUARRY AND AT THE NEARBY ST. CHARLES COUNTY WELL FIELD IS MONITORED ROUTINELY, AND MITIGATIVE MEASURES WOULD BE TAKEN IF ELEVATED CONCENTRATIONS WERE DETECTED IN THE WELL FIELD. THUS, BECAUSE THERE ARE NO KNOWN OR INDICATED POINTS OF CURRENT EXPOSURE, THE GROUNDWATER PATHWAY IS INCOMPLETE AND WAS NOT CONSIDERED IN THE BRE. THE POTENTIAL RISKS ASSOCIATED WITH CONTAMINATED GROUNDWATER WILL, HOWEVER, WILL BE ADDRESSED IN THE COMPREHENSIVE RISK ASSESSMENT TO BE PREPARED FOLLOWING IMPLEMENTATION OF THE BULK WASTE REMEDIAL ACTION AND COMPLETION OF DETAILED CHARACTERIZATION OF THE QUARRY AREA. NO PRIVATE RESIDENCES OR OTHER STRUCTURES ARE LOCATED WITHIN THE AREA THAT COULD BE IMPACTED BY RELEASES FROM THE QUARRY.

BASED ON AN EVALUATION OF WASTE CHARACTERISTICS AND POTENTIAL RELEASE MECHANISMS, THE BRE IDENTIFIED THE PRINCIPAL CONTAMINANTS AT THE QUARRY TO WHICH INDIVIDUALS COULD BE EXPOSED AND THE POTENTIAL ROUTES OF HUMAN EXPOSURE TO THESE CONTAMINANTS AS:

* INHALATION OF RADON-222, RADON-220, AND THEIR SHORT-LIVED DECAY PRODUCTS.

* EXPOSURE TO EXTERNAL GAMMA RADIATION.

* INHALATION OF RADIOACTIVELY AND CHEMICALLY CONTAMINATED AIRBORNE DUSTS.

* DERMAL CONTACT WITH CHEMICALLY CONTAMINATED SURFACE SOILS.

* INGESTION OF RADIOACTIVELY AND CHEMICALLY CONTAMINATED SURFACE SOILS.



SCENARIOS OF HUMAN ACTIVITIES THAT COULD RESULT IN EXPOSURES BY THESE PATHWAYS WERE DEVELOPED FOR INDIVIDUALS TEMPORARILY OCCUPYING THE IMPACTED AREA. "PASSERBY" AND "TRESPASSER" SCENARIOS WERE EVALUATED. THESE SCENARIOS WERE REALISTIC BUT CONSERVATIVE DESCRIPTIONS OF ACTIVITIES THAT COULD RESULT IN HUMAN EXPOSURES TO QUARRY CONTAMINANTS. UNDER EACH SCENARIO, TWO "CASES" WERE DEVELOPED TO ESTIMATE "REPRESENTATIVE" EXPOSURE AND "PLAUSIBLE MAXIMUM" EXPOSURE.

THE PASSERBY SCENARIO CONSIDERED POTENTIAL EXPOSURES TO AN INDIVIDUAL WHO ROUTINELY WALKS BY THE NORTHERN BOUNDARY OF THE QUARRY ALONG STATE ROUTE 94. FOR THE REPRESENTATIVE EXPOSURE CASE, IT WAS ASSUMED THAT THE INDIVIDUAL WALKS BY THE QUARRY TWICE PER DAY, 250 DAYS PER YEAR OVER A PERIOD OF FIVE YEARS; FOR THE PLAUSIBLE MAXIMUM EXPOSURE CASE, THE EXPOSURE PERIOD WAS INCREASED TO 365 DAYS PER YEAR OVER A PERIOD OF 10 YEARS. THE EXPOSURE PATHWAYS EVALUATED FOR THIS SCENARIO WERE INHALATION OF RADON-222 AND RADON-220 AND THEIR SHORT-LIVED DECAY PRODUCTS, EXPOSURE TO EXTERNAL GAMMA RADIATION, AND INHALATION OF DUSTS CONTAMINATED WITH NITROAROMATIC COMPOUNDS AND URANIUM. (NITROAROMATIC COMPOUNDS AND URANIUM ARE THE ONLY CONTAMINANTS FOUND IN EXPOSED AREAS OF THE QUARRY THAT ARE SUBJECT TO FUGITIVE DUST EMISSIONS.)

THE TRESPASSER SCENARIO CONSIDERED EXPOSURES TO A YOUTH WHO ENTERS THE QUARRY SEVERAL TIMES PER YEAR. FOR THE REPRESENTATIVE EXPOSURE CASE, IT WAS ASSUMED THAT AN INDIVIDUAL (11 TO 15 YEARS OLD) ENTERS THE QUARRY, REMAINS THERE FOR A PERIOD OF TWO HOURS, AND REPEATS THIS ACTIVITY 12 TIMES PER YEAR OVER A PERIOD OF FIVE YEARS. FOR THE PLAUSIBLE MAXIMUM EXPOSURE CASE, IT WAS ASSUMED THAT AN INDIVIDUAL (9 TO 18 YEARS OLD) ENTERS THE QUARRY ONCE PER WEEK FOR A PERIOD OF FOUR HOURS, 50 WEEKS PER YEAR OVER A PERIOD OF 10 YEARS. THE EXPOSURE PATHWAYS EVALUATED FOR THE TRESPASSER SCENARIO INCLUDED THE SAME PATHWAYS CONSIDERED FOR THE PASSERBY AS WELL AS DIRECT CONTACT WITH CONTAMINATED SOILS, WHICH COULD RESULT IN DERMAL ABSORPTION OF THE ORGANIC INDICATOR CHEMICALS AND INCIDENTAL INGESTION OF ALL COMPOUNDS.

THE CONDITIONS OF THE PASSERBY SCENARIO WERE SELECTED TO REPRESENT (1) THE EXPOSURE OCCURRING AT THE LOCATION OF HIGHEST OFF-SITE RADON AND AIRBORNE PARTICULATE CONCENTRATIONS (ALONG STATE ROUTE 94) AND (2) A FREQUENCY AND DURATION OF EXPOSURE (I.E., DAILY, FOR A TOTAL DURATION OF 24 MINUTES) THAT, OVER THE LONG TERM, WOULD NOT BE EXCEEDED BY AN

INDIVIDUAL ROUTINELY ENTERING ANY AREA IMPACTED BY CONTAMINANT RELEASES FROM THE QUARRY. THUS, ALTHOUGH OTHER POTENTIAL RECEPTORS WERE IDENTIFIED (E.G., INDIVIDUALS DRIVING BY THE QUARRY ON STATE ROUTE 94 OR A HIKER ON THE MISSOURI RIVER STATE TRAIL), THEY WERE NOT EXPLICITLY EVALUATED BECAUSE THEIR EXPOSURES WOULD BE SIMILAR TO, OR LESS THAN, THE EXPOSURES ESTIMATED FOR THE PASSERBY. ALTHOUGH ACCESS TO THE QUARRY IS RESTRICTED BY A CHAIN-LINK FENCE, THE AREA IS NOT GUARDED, HENCE IT IS REASONABLE TO ASSUME THAT A TRESPASSER COULD ENTER THE CONTAMINATED AREA. THE TRESPASSER SCENARIO IS CONSIDERED TO BE A CONSERVATIVE ESTIMATE OF POTENTIAL EXPOSURES TO ANY INDIVIDUAL COMING INTO DIRECT



CONTACT WITH THE CONTAMINATION IN THE QUARRY.

POTENTIAL HEALTH RISKS

THE BRE ASSESSED THE RADIOLOGICAL AND CHEMICAL HEALTH RISKS RESULTING FROM POTENTIAL EXPOSURES TO THE QUARRY CONTAMINANTS UNDER CURRENT SITE CONDITIONS. HEALTH EFFECTS RESULTING FROM RADIATION EXPOSURE WERE EVALUATED IN TERMS OF THE INCREASED LIKELIHOOD OF INDUCING FATAL CANCERS AND SERIOUS GENETIC EFFECTS IN FUTURE GENERATIONS. THE RISK OF CANCER INDUCTION FROM THE RADIONUCLIDES PRESENT IN THE QUARRY BULK WASTES IS MUCH GREATER THAN THE RISK OF SERIOUS GENETIC EFFECTS. THE POTENTIAL FOR ADVERSE HEALTH EFFECTS (OTHER THAN CANCER) FROM EXPOSURE TO CHEMICAL CONTAMINANTS WAS ASSESSED BY DIVIDING THE ESTIMATED AVERAGE DAILY INTAKE BY ESTABLISHED REFERENCE DOSES. THIS CALCULATION DETERMINED THE "HAZARD INDEX". A HAZARD INDEX OF LESS THAN 1 INDICATES A NONHAZARDOUS SITUATION WHILE A HAZARD INDEX GREATER THAN 1 INDICATES A POTENTIAL FOR ADVERSE HEALTH EFFECTS.

THE ESTIMATED CARCINOGENIC RISKS AND HAZARD INDEXES FOR THE PASSERBY AND TRESPASSER SCENARIOS ARE SUMMARIZED IN TABLE 6. THE CARCINOGENIC RISKS FROM RADIATION EXPOSURES RANGE FROM 4.2 X (10-6) FOR THE PASSERBY REPRESENTATIVE EXPOSURE CASE TO 8.7 X (10-5) FOR THE TRESPASSER PLAUSIBLE MAXIMUM EXPOSURE CASE, AND THE CARCINOGENIC RISKS FROM CHEMICAL EXPOSURES RANGE FROM 1.0 X (10-9) TO 3.6 X (10-5), RESPECTIVELY. THE RISK FROM RADIATION EXPOSURE EXCEEDS THAT FROM CHEMICAL EXPOSURE FOR BOTH SCENARIOS. THE MAJOR EXPOSURE PATHWAY FOR THE RADIOLOGICAL RISK IN ALL CASES IS INHALATION OF RADON-222 AND ITS SHORT-LIVED DECAY PRODUCTS. THE MAJOR CONTRIBUTOR TO THE CHEMICAL CARCINOGENIC RISK FOR THE TRESPASSER IS 2,4,6-TNT, WHICH ACCOUNTS FOR APPROXIMATELY 40 PERCENT OF THE RISK; ARSENIC, PCBS, AND PAHS ACCOUNT FOR THE REMAINING 60 PERCENT.

THE VERY LOW HAZARD INDEXES ESTIMATED FOR THE PASSERBY SCENARIO (LESS THAN 2 X (10-3)) INDICATE THAT THERE IS LITTLE POTENTIAL FOR NONCARCINOGENIC HEALTH IMPACTS TO INDIVIDUALS OUTSIDE THE QUARRY. HOWEVER, FOR THE TRESPASSER, THE HAZARD INDEX IS 2.0 FOR THE REPRESENTATIVE EXPOSURE CASE AND 8.5 FOR THE PLAUSIBLE MAXIMUM EXPOSURE CASE. FOR BOTH CASES, THE MAJOR CONTRIBUTOR TO THE NONCARCINOGENIC HAZARD IS EXPOSURE TO 2,4,6-TNT. THIS IS NOT UNEXPECTED GIVEN THE PRESENCE OF THIS CONTAMINANT AT CONCENTRATIONS GREATER THAN 1 PERCENT IN

SURFACE SOILS AT THE QUARRY. THE ESTIMATED HAZARD INDEXES FOR 2,4,6-TNT ARE 1.7 AND 7.2 FOR THE REPRESENTATIVE AND PLAUSIBLE MAXIMUM TRESPASSER EXPOSURE CASES, RESPECTIVELY. THESE RESULTS INDICATE THE POTENTIAL FOR THE OCCURRENCE OF ADVERSE HEALTH EFFECTS TO AN UNPROTECTED INDIVIDUAL FREQUENTLY ENTERING THE QUARRY. HOWEVER, UNDER CURRENT SITE CONDITIONS IN WHICH ACCESS TO THE QUARRY IS RESTRICTED, IT IS UNLIKELY THAT AN INDIVIDUAL WOULD ROUTINELY ENTER THE QUARRY.

POTENTIAL ENVIRONMENTAL RISKS



THE POTENTIAL RISKS TO THE ENVIRONMENT CONSIDERED IN THE BRE WERE IMPACTS ON SOIL RESOURCES, AIR QUALITY, VEGETATION AND WILDLIFE, AND WATER RESOURCES. NO ADVERSE IMPACTS HAVE BEEN OBSERVED FOR SOIL RESOURCES, AIR QUALITY, OR VEGETATION AND WILDLIFE AS A RESULT OF THE BULK WASTES IN THE QUARRY. THE MAJOR IMPACT THAT COULD RESULT FROM GASEOUS RELEASES, I.E., RADON, IS ADDRESSED IN THE HUMAN HEALTH ASSESSMENT PORTION OF THE BRE.

WATER RESOURCES HAVE BEEN IMPACTED BY THE PRESENCE OF THE BULK WASTES. THE PONDED WATER IS ALREADY CONTAMINATED AS A RESULT OF CONTACT WITH THE BULK WASTES, BUT INCREMENTAL CONTAMINATION FROM CONTINUED CONTACT, E.G., FUTURE SURFACE RUNOFF, IS NOT EXPECTED TO SIGNIFICANTLY ALTER THE EXISTING WATER QUALITY. SIMILARLY, FEMME OSAGE SLOUGH, SOUTH OF THE QUARRY, ALREADY CONTAINS RADIOACTIVE AND CHEMICAL CONTAMINANTS. THIS CONTAMINATION MAY HAVE RESULTED FROM SUBSURFACE MIGRATION FROM AREAS NORTH OF THE SLOUGH AND/OR FROM PAST DISCHARGES INTO LITTLE FEMME OSAGE CREEK. GROUNDWATER IN THE VICINITY OF THE QUARRY HAS BEEN CONTAMINATED AS A RESULT OF CONTAMINANT MIGRATION FROM THE BULK WASTES. IF THE BULK WASTES REMAIN IN THE QUARRY, CONTAMINANTS COULD MIGRATE FARTHER INTO THE SURROUNDING ENVIRONMENT VIA THE FRACTURED LIMESTONE OF THE KIMMSWICK LIMESTONE FORMATION, AND CONTAMINANT CONCENTRATIONS MIGHT INCREASE IN THE VICINITY OF FEMME OSAGE SLOUGH.

#PARA
POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

SECTION 121(D)(2) OF CERCLA REQUIRES THAT FOR ANY HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT THAT REMAINS ON SITE, THE REMEDIAL ACTION MUST ATTAIN A LEVEL OR STANDARD OF CONTROL AT LEAST EQUAL TO REQUIREMENTS, CRITERIA, OR LIMITATIONS UNDER FEDERAL ENVIRONMENTAL LAWS OR MORE STRINGENT STATE ENVIRONMENTAL LAWS OR FACILITY SITING LAWS WHICH ARE LEGALLY APPLICABLE OR RELEVANT AND APPROPRIATE (ARAR) UNDER THE CIRCUMSTANCES OF THE RELEASE OR THREATENED RELEASE AT THE COMPLETION OF THE REMEDIAL ACTION. FURTHERMORE, THE NCP REQUIRES ATTAINMENT OF ARARS DURING IMPLEMENTATION OF A REMEDIAL ACTION WHEN AN ARAR IS PERTINENT TO THE ACTION ITSELF AS WELL AS AT THE COMPLETION OF THE ACTION. UNDER CERTAIN CONDITIONS, COMPLIANCE WITH THESE ARARS MAY BE WAIVED.

THE LIMITED SCOPE OF THE QUARRY BULK WASTE OPERABLE UNIT REMEDIAL

ACTION, INCLUDING THE FACT THAT IT IS NOT THE FINAL REMEDIAL ACTION FOR EITHER THE BULK WASTES OR THE QUARRY, WAS CONSIDERED IN ANALYZING POTENTIAL ARARS.

A NUMBER OF FEDERAL AND STATE ENVIRONMENTAL LAWS WERE EVALUATED AS TO LEGAL APPLICABILITY OR RELEVANCE AND APPROPRIATENESS TO THE CIRCUMSTANCES OF THE RELEASES AND THREATENED RELEASES AT THE QUARRY. THOSE REQUIREMENTS CONSIDERED TO BE MOST LIKELY TO BE APPLICABLE OR RELEVANT AND APPROPRIATE TO THE REMEDIAL ALTERNATIVES UNDER CONSIDERATION ARE DISCUSSED BELOW.



FEDERAL ENVIRONMENTAL LAWS

RESOURCE CONSERVATION AND RECOVERY ACT

SUBTITLE C OF THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) REGULATES THE GENERATION, TRANSPORTATION, TREATMENT, STORAGE AND DISPOSAL OF HAZARDOUS WASTES AS DEFINED IN 40 CFR 261. RCRA INCLUDES SEVERAL REQUIREMENTS THAT MIGHT BE APPLICABLE OR RELEVANT AND APPROPRIATE TO THE REMEDIAL ACTION ALTERNATIVES UNDER CONSIDERATION, INCLUDING REQUIREMENTS AND STANDARDS PERTAINING TO CLOSURE OF HAZARDOUS WASTE MANAGEMENT UNITS, GROUNDWATER MONITORING, LOCATION STANDARDS, MINIMUM TECHNOLOGY REQUIREMENTS, LAND DISPOSAL RESTRICTIONS, AND UNIT DESIGN AND OPERATING STANDARDS.

UNDER 40 CFR 261, A SOLID WASTE IS A REGULATED HAZARDOUS WASTE IF IT IS NOT OTHERWISE EXCLUDED FROM REGULATION AS A HAZARDOUS WASTE AND EXHIBITS ANY OF THE CHARACTERISTICS IDENTIFIED IN 40 CFR 261 SUBPART C, OR IS LISTED IN 40 CFR 261 SUBPART D, OR IS A MIXTURE OF A SOLID WASTE AND A HAZARDOUS WASTE LISTED IN 40 CFR 261 SUBPART D.

RCRA HAZARDOUS WASTE MANAGEMENT REQUIREMENTS WOULD BE LEGALLY APPLICABLE TO THIS REMEDIAL ACTION IF A COMBINATION OF THE FOLLOWING CONDITIONS WERE MET:

1. THE WASTE IS A REGULATED HAZARDOUS WASTE, AS DESCRIBED ABOVE, AND EITHER

2A. THE WASTE WAS TREATED, STORED, OR DISPOSED OF AFTER THE EFFECTIVE DATE OF THE RCRA REQUIREMENTS, OR

2B. THE ACTIVITY AT THE CERCLA SITE CONSTITUTES TREATMENT, STORAGE, OR DISPOSAL AS DEFINED BY RCRA.

ALTHOUGH THE QUARRY BULK WASTES WERE NOT TREATED, STORED, OR DISPOSED OF AFTER THE EFFECTIVE DATE OF RCRA, SOME OF THE REMEDIAL ALTERNATIVES CONSIDERED WOULD INCLUDE ACTIVITIES CURRENTLY REGULATED BY RCRA IF THE BULK WASTES ARE RCRA HAZARDOUS WASTES. THEREFORE, AN EVALUATION OF THE APPLICABILITY OF RCRA SUBTITLE C REQUIREMENTS TO THE VARIOUS RESPONSE ALTERNATIVES MUST INCLUDE A DETERMINATION AS TO WHETHER THE BULK WASTES

ARE RCRA REGULATED HAZARDOUS WASTES.

IN ORDER TO DETERMINE IF THE QUARRY CONTAINS LISTED WASTES, IT IS NECESSARY TO CONSIDER INFORMATION AS TO THE SOURCE OF THE WASTES. BASED ON THE SOURCE OF THE QUARRY BULK WASTES, THE MATERIALS DISPOSED OF IN THE QUARRY COULD HAVE INCLUDED THE FOLLOWING HAZARDOUS WASTES THAT ARE LISTED IN 40 CFR 261 SUBPART D:

* K-044 LISTED WASTES, WHICH ARE DEFINED AS WASTEWATER TREATMENT SLUDGES FROM THE MANUFACTURING AND PROCESSING OF



EXPLOSIVES.

* K-047 LISTED WASTES, WHICH ARE DEFINED AS PINK/RED WATER FROM TNT OPERATIONS.

* U-105 LISTED WASTE, WHICH IS THE COMMERCIAL CHEMICAL PRODUCT, MANUFACTURING INTERMEDIATE, OR OFF-SPECIFICATION COMMERCIAL CHEMICAL PRODUCT 2,4-DINITROTOLUENE.

* U-106 LISTED WASTE, WHICH IS THE COMMERCIAL CHEMICAL PRODUCT,MANUFACTURING INTERMEDIATE, OR OFF-SPECIFICATION COMMERCIAL CHEMICAL PRODUCT 2,6-DINITROTOLUENE.

AN EXTENSIVE DOCUMENT SEARCH WAS CONDUCTED OF ALL AVAILABLE RECORDS AND REPORTS PERTAINING TO THE SOURCES OF THE WASTES DISPOSED OF IN THE QUARRY. WHILE THE RESULTS OF THIS SEARCH INDICATE THAT BOTH WASTEWATER TREATMENT SLUDGES FROM THE MANUFACTURING OF EXPLOSIVES AND PINK/RED WATER FROM TNT OPERATIONS WERE GENERATED AT THE WELDON SPRING ORDNANCE WORKS FACILITY, NO INFORMATION WAS FOUND TO SUBSTANTIATE THAT SUCH WASTES WERE DISPOSED OF IN THE QUARRY. FURTHERMORE, THERE IS NO INFORMATION TO SUGGEST THAT COMMERCIAL CHEMICAL PRODUCTS, MANUFACTURING INTERMEDIATES, OR OFF-SPECIFICATION COMMERCIAL CHEMICAL PRODUCTS 2,4-DINITROTOLUENE OR 2,6-DINITROTOLUENE WERE DISPOSED OF IN THE QUARRY. IT IS CONCLUDED, THEREFORE, THAT THE QUARRY BULK WASTES ARE NOT A LISTED HAZARDOUS WASTE UNDER RCRA.

NONE OF THE QUARRY BULK WASTE SAMPLES TESTED TO DATE HAVE EXHIBITED ANY OF THE RCRA HAZARDOUS WASTE CHARACTERISTICS. THEREFORE, THE DOE CONSIDERS THE QUARRY BULK WASTE NOT TO BE A RCRA CHARACTERISTIC HAZARDOUS WASTE, AND THE RCRA SUBTITLE C REQUIREMENTS ARE NOT LEGALLY APPLICABLE. THIS TESTING IS NOT CONCLUSIVE, HOWEVER, GIVEN THAT THE HETEROGENEITY OF THE WASTE MASS PRECLUDES REPRESENTATIVE SAMPLING OF THE IN-PLACE MATERIAL. IN ADDITION, THE EPA HAS RECENTLY ESTABLISHED AN ADDITIONAL RCRA CHARACTERISTIC TEST (TOXICITY CHARACTERISTIC LEACHING POTENTIAL (TCLP)) WHICH HAS NOT YET BEEN PERFORMED ON THE WASTE MATERIAL.

HOWEVER, EVEN IF THESE REQUIREMENTS ARE NOT LEGALLY APPLICABLE TO THE RESPONSE ACTION, THEY MAY BE RELEVANT AND APPROPRIATE TO THE CIRCUMSTANCES OF THE RELEASE OR THREATENED RELEASE. A DETERMINATION OF

RELEVANCE AND APPROPRIATENESS INCLUDES CONSIDERATION OF A NUMBER OF FACTORS, INCLUDING THE PURPOSE OF THE REQUIREMENT AND THE PURPOSE OF THE CERCLA ACTION, THE MEDIUM REGULATED OR AFFECTED BY THE REQUIREMENT AND THE MEDIUM CONTAMINATED OR AFFECTED BY THE CERCLA SITE, THE SUBSTANCES REGULATED BY THE REQUIREMENT AND THE SUBSTANCES FOUND AT THE CERCLA SITE, AND THE ACTIONS OR ACTIVITIES REGULATED BY THE REQUIREMENT AND THE REMEDIAL ACTION CONTEMPLATED AT THE CERCLA SITE.

THE AVAILABLE DATA INDICATE THAT THE DNT CONTAMINATED SOIL AND DEBRIS IN THE QUARRY IS PRESENT IN LOW CONCENTRATIONS AND DISPERSED IN SOIL OVER A



WIDE AREA. THUS, EVEN THOUGH SOME HAZARDOUS CONSTITUENTS ARE PRESENT IN THE QUARRY BULK WASTES, THE LOW CONCENTRATIONS AND THE PHYSICAL AND CHEMICAL CONDITION OF THE CONTAMINATED SOILS AND DEBRIS MATRIX OF THE WASTES ARE INHERENTLY DIFFERENT FROM WHAT WAS ENVISIONED BY RCRA. THEREFORE, THE DOE DOES NOT CONSIDER RCRA SUBTITLE C REQUIREMENTS TO BE RELEVANT AND APPROPRIATE ON THE BASIS OF SIMILARITY OF THE WASTES PRESENT AT THE SITE TO A RCRA LISTED WASTE.

HOWEVER, SOME OF THE WASTES PRESENT IN THE QUARRY MAY EXHIBIT CHARACTERISTICS SIMILAR TO RCRA HAZARDOUS WASTES. FURTHERMORE, SOME OF THE REMEDIAL ALTERNATIVES UNDER CONSIDERATION FOR THE QUARRY ARE SIMILAR TO SOME OF THE HAZARDOUS WASTE ACTIONS REGULATED BY RCRA. THEREFORE, IN ANALYZING THE VARIOUS REMEDIAL ALTERNATIVES FOR COMPLIANCE WITH ARARS, THE DOE WILL CONSIDER WHETHER RCRA REQUIREMENTS FOR HAZARDOUS WASTES ARE RELEVANT AND APPROPRIATE.

PRIOR TO SELECTION OF THE FINAL REMEDIAL ACTION FOR TREATMENT AND/OR DISPOSAL OF THE QUARRY BULK WASTES, ADDITIONAL TESTS WILL BE PERFORMED ONCE THE WASTES HAVE BEEN PLACED IN STORAGE TO ESTABLISH MORE DEFINITIVELY WHETHER THE QUARRY BULK WASTES ARE RCRA CHARACTERISTIC HAZARDOUS WASTES. THIS INFORMATION WILL THEN BE CONSIDERED IN FUTURE DECISION MAKING PROCESSES REGARDING SUBSEQUENT MANAGEMENT OF THE QUARRY BULK WASTES.

SAFE DRINKING WATER ACT

POTENTIAL ARARS UNDER THE SAFE DRINKING WATER ACT (SDWA) INCLUDE MAXIMUM CONTAMINANT LEVELS (MCLS) AND MAXIMUM CONTAMINANT LEVEL GOALS (MCLGS). MCLS ARE ENFORCEABLE STANDARDS WHICH APPLY TO PUBLIC DRINKING WATER SUPPLIES. MCLGS ARE UNENFORCEABLE HEALTH BASED GOALS FOR MAXIMUM CONTAMINANT LEVELS IN DRINKING WATER. SECTION 121(D)(2) OF CERCLA REQUIRES ON-SITE REMEDIES TO ATTAIN MCLGS IF THEY ARE RELEVANT AND APPROPRIATE TO THE RELEASE.

THE DOE DOES NOT CONSIDER EITHER MCLS OR MCLGS TO BE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR THIS ACTION SINCE THIS OPERABLE UNIT REMEDIAL ACTION DOES NOT ADDRESS GROUNDWATER REMEDIATION. MCLS AND MCLGS WILL BE EVALUATED AS POTENTIAL ARARS DURING THE DECISION MAKING PROCESS FOR GROUNDWATER AT, AND DOWNGRADIENT OF, THE QUARRY.

CLEAN WATER ACT

POTENTIAL ARARS UNDER THE CLEAN WATER ACT (CWA) INCLUDE FEDERAL WATER QUALITY CRITERIA, STANDARDS FOR DISCHARGE OF WASTES TO PUBLICLY OWNED TREATMENT WORKS (POTW), EFFLUENT LIMITATIONS AND GUIDELINES FOR DISCHARGES DIRECTLY TO WATERS OF THE UNITED STATES, AND REQUIREMENTS FOR DREDGE AND FILL ACTIVITIES. THE DOE DOES NOT CONSIDER ANY OF THESE REQUIREMENTS TO BE EITHER APPLICABLE OR RELEVANT AND APPROPRIATE TO THIS OPERABLE UNIT REMEDIAL ACTION BECAUSE THE ACTION DOES NOT INVOLVE REMEDIATION OF RELEASES TO WATERS OF THE UNITED STATES, DISCHARGES TO



EITHER A POTW OR TO WATERS OF THE UNITED STATES, OR DREDGE AND FILL ACTIVITIES. POTENTIAL ARARS UNDER THE CWA WILL BE EVALUATED DURING SUBSEQUENT REMEDIAL ACTION DECISION MAKING.

CLEAN AIR ACT

POTENTIAL ARARS UNDER THE CLEAN AIR ACT (CAA) INCLUDE NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAPS) AND NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS). THE NESHAP REQUIREMENTS ARE CODIFIED IN 40 CFR 61 AND THE NAAQS REQUIREMENTS ARE CODIFIED IN 40 CFR 50. THE NESHAP PROVISIONS OF THE CAA AUTHORIZE THE ADMINISTRATOR OF THE EPA TO ESTABLISH EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS. THE NESHAP PROVISIONS FURTHER LIMIT THE CONSTRUCTION OF NEW SOURCES OR MODIFICATION OF EXISTING SOURCES WHICH WILL NOT BE IN COMPLIANCE WITH SUCH EMISSION STANDARDS. THE NESHAP STANDARDS HAVE BEEN SET FOR SEVERAL CONTAMINANTS PRESENT IN THE QUARRY BULK WASTES WHICH ARE CURRENTLY BEING RELEASED INTO THE AIR OR WHICH MAY BE RELEASED DURING REMEDIAL ALTERNATIVES UNDER CONSIDERATION. THESE CONTAMINANTS INCLUDE RADIONUCLIDES, ARSENIC, AND ASBESTOS.

THE STANDARDS FOR RADIONUCLIDES IN 40 CFR 61 ARE APPLICABLE TO REMEDIAL ALTERNATIVES UNDER CONSIDERATION.

THE STANDARDS FOR ARSENIC IN 40 CFR 61 ARE BASED ON GLASS MANUFACTURING, PRIMARY COPPER SMELTING, AND ARSENIC TRIOXIDE AND METALLIC ARSENIC PRODUCTION. THESE STANDARDS ARE NOT APPLICABLE TO ANY ASPECT OF THIS OPERABLE UNIT REMEDIAL ACTION SINCE THE SOURCE OF THE AIR EMISSIONS IS NOT A SOURCE ADDRESSED BY THE REGULATIONS DEFINING THE STANDARD. FURTHERMORE, AFTER EVALUATING THE PURPOSE OF THE REQUIREMENT VERSUS THE PURPOSE OF THE QUARRY RESPONSE ACTION AND TAKING INTO CONSIDERATION THE ACTIONS REGULATED BY THE REQUIREMENT VERSUS THE ACTION CONTEMPLATED FOR THE QUARRY, THE DOE DOES NOT CONSIDER THESE STANDARDS TO BE RELEVANT AND APPROPRIATE. THE DOE CONSIDERS OTHER EMISSION STANDARDS, SUCH AS THE STANDARDS FOUND AT 29 CFR 1910.1000 FOR COMPLIANCE WITH THE OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA), TO BE BETTER SUITED TO THE REMEDIAL ALTERNATIVES UNDER CONSIDERATION.

THE ASBESTOS STANDARD IN 40 CFR 61 REQUIRING NO VISIBLE EMISSIONS IS CONSIDERED TO BE APPLICABLE TO SOME OF THE REMEDIAL ALTERNATIVES UNDER CONSIDERATION.

THE CAA PROVIDES FOR THE PROMULGATION OF TWO TYPES OF NAAQS, I.E., PRIMARY AND SECONDARY STANDARDS, WHICH APPLY TO THE AMBIENT AIR. PRIMARY AMBIENT AIR QUALITY STANDARDS ARE STANDARDS WHICH THE ADMINISTRATOR OF THE EPA FINDS TO BE NECESSARY TO PROTECT PUBLIC HEALTH. SECONDARY STANDARDS ARE THOSE STANDARDS WHICH THE ADMINISTRATOR OF THE EPA FINDS ARE NECESSARY TO PROTECT THE PUBLIC WELFARE FROM THE PRESENCE OF AIR POLLUTANTS IN AMBIENT AIR.

THE NAAQS ARE NOT ARARS BECAUSE THEY DO NOT APPLY DIRECTLY TO



SOURCE-SPECIFIC EMISSIONS; RATHER THEY ARE NATIONAL LIMITATIONS ON AMBIENT CONCENTRATIONS INTENDED TO PROTECT PUBLIC HEALTH AND WELFARE. THE STATE OF MISSOURI'S IMPLEMENTATION PLAN, HOWEVER, DOES PROVIDE SOURCE-SPECIFIC EMISSION LIMITATIONS AND IS CONSIDERED TO BE AN ARAR. THIS IS DISCUSSED IN SECTION 7.2.1 WHICH CONSIDERS MISSOURI AIR QUALITY STANDARDS.

TOXIC SUBSTANCES CONTROL ACT

POTENTIAL ARARS UNDER THE TOXIC SUBSTANCES CONTROL ACT (TSCA) INCLUDE STANDARDS AND REQUIREMENTS FOR THE STORAGE AND DISPOSAL OF PCBS, FOR CLEANUP OF PCB SPILLS AND FOR ASBESTOS ABATEMENT PROJECTS. PCB STORAGE AND DISPOSAL REQUIREMENTS ARE FOUND IN 40 CFR 761 SUBPART D. TSCA PCB STORAGE AND DISPOSAL REQUIREMENTS GENERALLY APPLY TO PCBS AT CONCENTRATIONS GREATER THAN 50 PPM; PCB ARTICLES, E.G. TRANSFORMERS, CAPACITORS, ETC.; PCB CONTAINERS WITH CONCENTRATIONS GREATER THAN 500 PPM; AND PCB SPILLS GREATER THAN 50 PPM.

ANY PCBS, PCB ARTICLES, AND PCB CONTAINERS IN THE QUARRY BULK WASTES WOULD HAVE BEEN PLACED THERE PRIOR TO THE EFFECTIVE DATE OF THESE REGULATIONS, SO THEY WOULD NOT BE LEGALLY APPLICABLE TO THESE WASTES AS THEY PRESENTLY EXIST. HOWEVER, VARIOUS REMEDIAL ALTERNATIVES UNDER CONSIDERATION COULD TRIGGER THE APPLICABILITY OF THESE REQUIREMENTS.

THE PCB SPILL CLEANUP POLICY, FOUND IN 40 CFR 761 SUBPART G, ESTABLISHES CRITERIA TO BE USED IN DETERMINING THE ADEQUACY OF THE CLEANUP OF SPILLS WHICH OCCURRED AFTER MAY 4, 1987, WHICH RESULTED IN THE RELEASE OF MATERIALS CONTAINING PCBS AT CONCENTRATIONS OF 50 PPM OR GREATER. SINCE ANY SPILLS RESULTING FROM THE PRESENCE OF PCBS IN THE BULK WASTES OCCURRED LONG BEFORE THIS DATE, THE PCB SPILL CLEANUP POLICY IS NOT APPLICABLE TO THIS REMEDIAL ACTION. HOWEVER, CERTAIN CLEANUP CRITERIA IN THE PCB SPILL CLEANUP POLICY MAY BE CONSIDERED RELEVANT AND APPROPRIATE TO SOME ASPECTS OF SOME OF THE REMEDIAL ALTERNATIVES UNDER CONSIDERATION.

VARIOUS REQUIREMENTS PERTAINING TO ASBESTOS ABATEMENT PROJECTS WERE PROMULGATED AT 40 CFR 731 SUBPART G. THESE REQUIREMENTS INCLUDE LIMITS ON PERMISSIBLE EXPOSURES OF WORKERS TO AIRBORNE CONCENTRATIONS OF ASBESTOS DURING ASBESTOS ABATEMENT PROJECTS, REQUIREMENTS FOR ASBESTOS REMOVAL, DEMOLITION AND RENOVATION OPERATIONS, AND EXPOSURE MONITORING.

SINCE THIS OPERABLE UNIT REMEDIAL ACTION DOES NOT FIT THE REGULATORY DEFINITION OF AN ASBESTOS ABATEMENT PROJECT, THESE STANDARDS AND REQUIREMENTS ARE NOT LEGALLY APPLICABLE TO THE REMEDIAL ALTERNATIVES UNDER CONSIDERATION. THE REQUIREMENTS DO, HOWEVER, INCLUDE HEALTH-BASED STANDARDS FOR ASBESTOS EXPOSURE AND MAY BE CONSIDERED RELEVANT AND APPROPRIATE TO CERTAIN ASPECTS OF SOME OF THE REMEDIAL ALTERNATIVES.

ATOMIC ENERGY ACT



IN REGULATIONS PROMULGATED PURSUANT TO THE ATOMIC ENERGY ACT (AEA), RADIATION EXPOSURE LIMITS AND ACCEPTABLE CONCENTRATIONS OF RADIONUCLIDES IN RESTRICTED AND UNRESTRICTED AREAS ARE ESTABLISHED IN 10 CFR 20. THESE STANDARDS ARE APPLICABLE ONLY TO ACTIVITIES CARRIED OUT UNDER LICENSES ISSUED BY THE US NUCLEAR REGULATORY COMMISSION (NRC). THESE REQUIREMENTS ARE NOT APPLICABLE TO THIS ACTION SINCE THE DOE IS NOT AN NRC LICENSEE. ALTHOUGH PORTIONS OF THE REQUIREMENTS GIVEN IN 10 CFR 20 COULD BE CONSIDERED RELEVANT TO THE QUARRY BULK WASTE REMEDIAL ACTION, THEY ARE NOT APPROPRIATE SINCE THE REQUIREMENTS ARE BASED ON RADIATION DOSIMETRY MODELS THAT ARE OUT OF DATE. THE RADIATION PROTECTION REQUIREMENTS GIVEN IN 10 CFR 20 ARE CURRENTLY BEING REVISED TO INCORPORATE NEW RADIATION DOSIMETRY CONSIDERATIONS. THE REQUIREMENTS IN DOE ORDERS FOR RADIATION PROTECTION OF INDIVIDUALS AND THE ENVIRONMENT HAVE RECENTLY BEEN UPDATED AND ARE COMPARABLE TO THOSE IN PROPOSED REVISIONS TO 10 CFR 20. REMEDIAL ACTIONS WILL BE CONDUCTED IN COMPLIANCE WITH DOE ORDERS FOR RADIATION PROTECTION WHICH ARE MORE UP TO DATE. PROVISIONS IN DOE ORDERS FOR RADIATION PROTECTION OF INDIVIDUALS AND THE ENVIRONMENT ARE IDENTIFIED IN SECTION 7.3 WHICH DISCUSSES "TO BE CONSIDERED" REQUIREMENTS.

THE REVISIONS TO 10 CFR 20 ARE EXPECTED TO BE PROMULGATED PRIOR TO REMOVAL OF THE BULK WASTE FROM THE QUARRY. THE REQUIREMENTS IN 10 CFR 20 WILL BE REVIEWED FOLLOWING REVISION TO ENSURE THAT ALL SUBSTANTIVE REQUIREMENTS ARE MET. ANY PROVISIONS IN THE REVISED 10 CFR 20 THAT ARE MORE RESTRICTIVE THAN REQUIREMENTS IN THE DOE ORDERS FOR RADIATION PROTECTION WILL BE COMPLIED WITH.

ENVIRONMENTAL RADIATION PROTECTION STANDARDS FOR NUCLEAR POWER OPERATIONS ARE APPLICABLE TO OPERATIONS WITHIN THE URANIUM FUEL CYCLE. THESE REQUIREMENTS ARE PUBLISHED IN 40 CFR 190 UNDER THE AUTHORITY OF THE AEA. ON THE BASIS OF JURISDICTIONAL PREREQUISITES, THE STANDARDS ARE NOT APPLICABLE, I.E., THE PROPOSED ACTION IS NOT PART OF THE NUCLEAR FUEL CYCLE AS DEFINED IN 40 CFR 190.02. FURTHER, THE REQUIREMENTS ARE CONSIDERED RELEVANT BUT NOT APPROPRIATE SINCE THE INTENT IS TO REGULATE NORMAL URANIUM FUEL CYCLE PRODUCTION OPERATIONS AND PLANNED DISCHARGES. THERE ARE VARIANCES IN THE REQUIREMENTS FOR UNUSUAL OCCURRENCES WHICH WOULD INCLUDE OPERATIONS SUCH AS IMPLEMENTATION OF THE PROPOSED ACTION. ALTHOUGH THESE STANDARDS ARE NOT ARAR, IT IS DOE POLICY TO MAINTAIN EXPOSURES AS LOW AS REASONABLY ACHIEVABLE.

URANIUM MILL TAILINGS RADIATION CONTROL ACT

PURSUANT TO THE URANIUM MILL TAILINGS RADIATION CONTROL ACT (UMTRCA), VARIOUS CONTROL STANDARDS FOR INACTIVE URANIUM PROCESSING SITES HAVE BEEN PROMULGATED. THESE STANDARDS WERE EVALUATED AS POTENTIAL ARARS FOR THE QUARRY BULK WASTE REMEDIAL ACTION. THE REQUIREMENTS ARE NOT APPLICABLE SINCE THE WELDON SPRING SITE IS NOT A URANIUM MILL TAILINGS SITE. FURTHERMORE, MOST OF THESE REQUIREMENTS ARE NOT CONSIDERED TO BE RELEVANT AND APPROPRIATE TO THIS ACTION PRIMARILY ON THE BASIS OF CONSIDERATION OF THE ACTIONS OR ACTIVITIES REGULATED BY THE REQUIREMENT



AND THE REMEDIAL ACTION CONTEMPLATED AT THIS SITE. FOR EXAMPLE, 40 CFR 192.12(B)(1) AND 40 CFR 192.12(B)(2) ARE CONSIDERED NOT RELEVANT NOR APPROPRIATE BECAUSE NO HABITABLE BUILDINGS ARE INVOLVED IN THE REMEDIAL ACTION. 40 CFR 192.12(A) MIGHT BE RELEVANT AND APPROPRIATE TO THE IDENTIFICATION AND MANAGEMENT OF RESIDUAL MATERIALS IN THE QUARRY, BUT THIS IS BEYOND THE SCOPE OF THE PROPOSED ACTION. THESE REQUIREMENTS WILL BE EVALUATED AS PART OF THE FOLLOW-ON REMEDIAL ACTIONS PLANNED FOR THE QUARRY.

HOWEVER, 40 CFR 192.02(B)(1), WHICH ADDRESSES RELEASES OF RADON FROM TAILINGS DISPOSAL PILES, IS CONSIDERED TO BE RELEVANT AND APPROPRIATE TO THOSE ASPECTS OF THE REMEDIAL ALTERNATIVES WHICH INVOLVE STORAGE OF THE BULK WASTES. AT COMPLETION, THE BULK WASTE STORAGE FACILITY WILL HAVE TO MEET THE RADON-222 FLUX STANDARDS SPECIFIED IN 40 CFR 192.02(B)(1). THIS STANDARD REQUIRES REASONABLE ASSURANCE THAT RADON-222 FROM RESIDUAL RADIOACTIVE MATERIAL WILL NOT (1) EXCEED AN AVERAGE RELEASE RATE OF 20 PICOCURIES PER SQUARE METER PER SECOND (20 PCI/M2/SEC), OR (2) INCREASE THE ANNUAL AVERAGE CONCENTRATION OF RADON-222 IN AIR AT OR ABOVE ANY LOCATION OUTSIDE THE SITE PERIMETER BY MORE THAN ONE-HALF PICOCURIE PER LITER (0.5 PCI/L).

OTHER POTENTIAL FEDERAL ARARS

OTHER FEDERAL LAWS, INCLUDING THE NATIONAL HISTORIC PRESERVATION ACT, THE ARCHEOLOGICAL PROTECTION ACT, THE ENDANGERED SPECIES ACT, THE FISH AND WILDLIFE COORDINATION ACT, THE WILDERNESS ACT, AND THE WILDLIFE MANAGEMENT ACT, WILL BE EVALUATED AS POTENTIAL ARARS IN LIGHT OF SPECIFIC REMEDIAL ACTION PROPOSALS.

STATE ENVIRONMENTAL AND FACILITY SITING LAWS

MISSOURI AIR QUALITY STANDARDS

THE STATE OF MISSOURI HAS ADOPTED THE NAAQS CRITERIA SPECIFIED IN THE CAA THROUGH THE STATE IMPLEMENTATION PLAN. THE STATE OF MISSOURI HAS PROMULGATED AMBIENT CONCENTRATION STANDARDS UNDER 10 CSR 10-6.010. IMPLEMENTATION OF SOME OF THE REMEDIAL ALTERNATIVES COULD RESULT IN EMISSIONS OF SEVERAL OF THE CRITERIA POLLUTANTS, INCLUDING PARTICULATE MATTER (50 G/M(3) ANNUAL AVERAGE OR 150 G/M(3) OVER A 24 HOUR PERIOD) AND LEAD (1.5 G/M(3) QUARTERLY AVERAGE)). AS STATED EARLIER, AMBIENT

STANDARDS FOR THESE CONTAMINANTS ARE NOT ARAR; HOWEVER THEY PROVIDE A SOUND TECHNICAL BASIS FOR ASSURING PROTECTION OF PUBLIC HEALTH AND WELFARE DURING IMPLEMENTATION AND WILL BE CONSIDERED FOR REMEDIAL ALTERNATIVES INVOLVING POTENTIAL AIR RELEASES.

MISSOURI AIR POLLUTION CONTROL REGULATIONS

VARIOUS STANDARDS TO CONTROL EMISSIONS OF PARTICULATE MATTER HAVE BEEN PROMULGATED UNDER MISSOURI AIR POLLUTION CONTROL REGULATIONS. THE STANDARDS ADDRESSED IN 10 CSR 10-5.050 ARE NOT APPLICABLE NOR RELEVANT



AND APPROPRIATE SINCE THE SOURCE DEFINITIONS RELATE TO INDUSTRIAL PROCESSES.

THE STANDARDS ADDRESSED IN 10 CSR 10-5.090 ARE NOT APPLICABLE NOR RELEVANT AND APPROPRIATE SINCE THE REQUIREMENT APPLIES TO SINGLE INDUSTRIAL SOURCE EMISSIONS.

THE STANDARDS ADDRESSED IN 10 CSR 10-5.100 ARE APPLICABLE TO THE PREVENTION OF AIRBORNE PARTICULATE MATTER DURING CONSTRUCTION ACTIVITIES. THE STANDARD OF CONTROL RELATES TO "UNNECESSARY AMOUNTS OF FUGITIVE EMISSIONS" AND MINIMIZING COMPLAINTS. PARTICULATE STANDARDS PROMULGATED UNDER 10 CSR 10-5.180 FOR INTERNAL COMBUSTION ENGINES (NO RELEASE FOR MORE THAN 10 SECONDS AT ONE TIME) ARE APPLICABLE DURING IMPLEMENTATION.

MISSOURI RADIATION REGULATIONS

THE MISSOURI DEPARTMENT OF HEALTH HAS ISSUED STANDARDS FOR PROTECTION AGAINST IONIZING RADIATION IN 19 CSR 20. THESE REQUIREMENTS ARE SIMILAR TO THOSE CURRENTLY IN 10 CFR 20. AS DISCUSSED IN SECTION 7.1.6, THESE STANDARDS ARE BASED ON RADIATION DOSIMETRY MODELS THAT ARE OUT OF DATE. THE REQUIREMENTS IN DOE ORDERS FOR RADIATION PROTECTION OF INDIVIDUALS AND THE ENVIRONMENT ARE MORE UP TO DATE. THE QUARRY BULK WASTE REMEDIAL ACTION WILL THEREFORE BE IMPLEMENTED USING DOE RADIATION PROTECTION REQUIREMENTS.

THERE ARE, HOWEVER, SPECIFIC STATE REQUIREMENTS THAT ARE MORE RESTRICTIVE THEN FEDERAL REQUIREMENTS, SPECIFICALLY A RADON-222 CONCENTRATION LIMIT OF 1 PCI/L IN UNCONTROLLED AREAS. BASELINE DATA INDICATE THAT RADON-222 LEVELS IN THE AREA CONTROLLED BY FENCING AROUND THE QUARRY RENDER COMPLIANCE WITH THIS REQUIREMENT UNACHIEVABLE DURING IMPLEMENTATION OF THE ACTION BASED REMEDIAL ACTION ALTERNATIVES. THIS REQUIREMENT COULD BE MET UPON COMPLETION OF THE ACTION BASED ALTERNATIVES.

MISSOURI HAZARDOUS WASTE MANAGEMENT LAWS

MISSOURI HAS ADOPTED BY REFERENCE A NUMBER OF THE RCRA SUBTITLE C HAZARDOUS WASTE MANAGEMENT REGULATIONS. TO THE EXTENT THAT STATE REQUIREMENTS ARE THE SAME AS FEDERAL REQUIREMENTS, THE STATE

REQUIREMENTS ARE NOT MORE STRINGENT AND WILL NOT BE FURTHER CONSIDERED AS ARARS. HOWEVER, MISSOURI HAS ALSO ADOPTED SOME REQUIREMENTS WHICH ARE NOT IDENTICAL TO THE FEDERAL REQUIREMENTS, INCLUDING LANDFILL SITING REQUIREMENTS, WASTE PILE LOCATION REQUIREMENTS, AND STORAGE FACILITY LINING REQUIREMENTS, WHICH MAY BE MORE STRINGENT THAN FEDERAL REQUIREMENTS. AS DISCUSSED ABOVE UNDER POTENTIAL RCRA ARARS, THESE STATE HAZARDOUS WASTE MANAGEMENT REQUIREMENTS ARE NOT CONSIDERED LEGALLY APPLICABLE TO THE BULK WASTES, BUT MAY BE RELEVANT AND APPROPRIATE.

OTHER POTENTIAL STATE ARARS



OTHER STATE LAWS WILL BE CONSIDERED IN LIGHT OF SPECIFIC REMEDIAL ACTION PROPOSALS.

TO BE CONSIDERED REQUIREMENTS

THE NCP PROVIDES THAT IN ADDITION TO APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, OTHER ADVISORIES, CRITERIA, AND GUIDANCE MAY BE CONSIDERED FOR A PARTICULAR RELEASE. DOE ORDERS, WHICH ARE NOT ARARS IN THAT THEY ARE NOT PROMULGATED STANDARDS (E.G., PUBLIC LAWS CODIFIED AT THE STATE OR FEDERAL LEVEL), PROVIDE A SOUND BASIS FOR CONDUCTING THIS ACTION. THE DOE WILL IMPLEMENT THIS ACTION IN COMPLIANCE WITH ALL OF ITS ORDERS, INDEPENDENT OF THEIR EVALUATION AS ARAR.

TWO OF THE MORE SIGNIFICANT ORDERS FOR THIS ACTION ARE DOE ORDERS 5400.5 AND 5480.11 WHICH PROVIDE REQUIREMENTS FOR RADIATION PROTECTION. THE KEY ELEMENTS OF THESE ORDERS ARE AS FOLLOWS.

DOE ORDER 5400.5--RADIATION PROTECTION OF THE PUBLIC AND THE ENVIRONMENT

THE BASIC DOSE LIMIT FOR PROTECTION OF MEMBERS OF THE GENERAL PUBLIC IS 100 MREM/YR, ABOVE BACKGROUND, EFFECTIVE DOSE EQUIVALENT FROM ALL EXPOSURE MODES. THIS DOSE IS THE SUM OF THE EFFECTIVE DOSE EQUIVALENT FROM ALL EXPOSURES TO RADIATION SOURCES EXTERNAL TO THE BODY DURING THE YEAR PLUS THE COMMITTED EFFECTIVE DOSE EQUIVALENT FROM RADIONUCLIDES TAKEN INTO THE BODY DURING THE YEAR. DOSES FROM SPECIFIC EXPOSURE MODES MUST COMPLY WITH THOSE REQUIRED BY OTHER FEDERAL STATUTES SUCH AS THE CAA AND THE SDWA. FURTHER, ALL RADIATION EXPOSURES MUST BE REDUCED TO LEVELS AS LOW AS REASONABLY ACHIEVABLE.

THE DOE DERIVED CONCENTRATION GUIDES (DCGS) FOR AIRBORNE RADIONUCLIDES ADDRESS PROTECTION OF THE GENERAL PUBLIC FROM AIRBORNE RADIOACTIVE CONTAMINANTS. THE DCGS ARE CONCENTRATIONS WHICH, UNDER CONDITIONS OF CONTINUOUS INHALATION EXPOSURE FOR ONE YEAR, WOULD RESULT IN AN EFFECTIVE DOSE EQUIVALENT OF 100 MREM. THE DCGS ARE PROVIDED IN CHAPTER III OF DOE ORDER 5400.5.

DOE ORDER 5480.11--RADIATION PROTECTION FOR OCCUPATIONAL WORKERS

THE EFFECTIVE DOSE EQUIVALENT RECEIVED BY ANY MEMBER OF THE PUBLIC

ENTERING A CONTROLLED AREA IS LIMITED TO 100 MREM/YR ABOVE BACKGROUND. IN ADDITION, EXPOSURES SHALL NOT CAUSE A DOSE EQUIVALENT TO ANY TISSUE (INCLUDING THE SKIN AND LENS OF THE EYE) TO EXCEED 5 REM/YR. THE LIMITS FOR ASSESSED DOSE FROM EXPOSURE OF WORKERS TO RADIATION ARE SHOWN ON TABLE 7. (THESE VALUES REPRESENT MAXIMUM LIMITS; IT IS DOE POLICY TO MAINTAIN RADIATION EXPOSURES AS FAR BELOW THESE LIMITS AS IS REASONABLY ACHIEVABLE.)

THE DOE DERIVED AIR CONCENTRATIONS (DACS) FOR AIRBORNE RADIONULIDES ADDRESS PROTECTION OF WORKERS FROM AIRBORNE RADIOACTIVE CONTAMINANTS.



THE DACS ARE BASED ON LIMITING EITHER THE COMMITTED EFFECTIVE DOSE EQUIVALENT TO 5 REM/YR, OR THE DOSE EQUIVALENT TO ANY ORGAN TO 50 REM/YR, WHICHEVER IS MORE RESTRICTIVE. IF AIRBORNE CONCENTRATIONS ARE LIKELY TO APPROACH OR EXCEED DACS, ARE PROVIDED IN ATTACHMENT 1 TO DOE ORDER 5480.11.

#DA
DESCRIPTION OF ALTERNATIVES

FOLLOWING AN ANALYSIS OF POTENTIALLY APPLICABLE RESPONSE TECHNOLOGIES THAT MIGHT SATISFY THE REMEDIAL ACTION GOALS FOR THE OPERABLE UNIT, FIVE ALTERNATIVES WERE DEVELOPED FOR FURTHER CONSIDERATION. IN ADDITION, A NO-ACTION ALTERNATIVE WAS INCLUDED TO PROVIDE THE BASELINE FOR A COMPARATIVE EVALUATION. HENCE, SIX PRELIMINARY REMEDIAL ALTERNATIVES HAVE BEEN EVALUATED. THESE ALTERNATIVES ARE AS FOLLOWS:

ALTERNATIVE 1: NO ACTION

THE NO-ACTION ALTERNATIVE IS INCLUDED AS A BASELINE FOR COMPARISON WITH THE OTHER ALTERNATIVES. AS PART OF THIS BASELINE CONDITION, NO FURTHER ACTION WOULD BE TAKEN AT THE QUARRY, I.E., THE BULK WASTES WOULD REMAIN IN THEIR CURRENT CONDITION BUT THE QUARRY WATER TREATMENT PLANT, SELECTED AS A REMOVAL ACTION UNDER THE PRECEDING EE/CA, WOULD BE IN OPERATION. INSTITUTIONAL CONTROLS CURRENTLY IN EFFECT AT THE QUARRY, INCLUDING FENCES AND LOCKED GATES, MONITORING, AND SITE OWNERSHIP, WOULD REMAIN IN PLACE.

ALTERNATIVE 2: SURFACE CONTAINMENT

UNDER ALTERNATIVE 2, ALL SURFACE VEGETATION WOULD BE REMOVED AND A SURFACE CONTAINMENT LAYER, SUCH AS A SOIL CAP OR SYNTHETIC GEOTEXTILE FABRIC, WOULD BE INSTALLED OVER THE ENTIRE AREA OF THE QUARRY. SURFACE CONTAINMENT WOULD REDUCE THE RELEASE OF CONTAMINANTS VIA SURFACE PATHWAYS (E.G., WIND DISPERSAL) AND COULD LIMIT PERCOLATION OF PRECIPITATION OR SNOWMELT THROUGH CONTAMINATED MATERIALS IN THE BULK WASTES. THIS WOULD REDUCE CONTAMINANT MIGRATION INTO THE GROUNDWATER. HOWEVER, SINCE THE BULK WASTES WOULD REMAIN IN CONTACT WITH THE GROUNDWATER, CONTAMINANT MIGRATION RESULTING FROM LATERAL FLOW OF GROUNDWATER THROUGH THE BULK WASTES WOULD NOT BE REDUCED.

ALTERNATIVE 3: SURFACE AND SUBSURFACE CONTAINMENT

UNDER ALTERNATIVE 3, THE QUARRY BULK WASTES WOULD BE ISOLATED IN PLACE BY INSTALLING A SURFACE LAYER, AS IN ALTERNATIVE 2, IN CONJUNCTION WITH PLACEMENT OF A NATURAL OR POLYMERIC GROUTING MATERIAL AROUND THE PERIPHERY OF THE QUARRY AND BENEATH THE ENTIRE AREA AT A DEPTH GREATER THAN THAT OF THE BURIED WASTES. THE COMPONENTS OF ALTERNATIVE 3 ARE THE SAME AS THOSE OF ALTERNATIVE 2, I.E., SURFACE PREPARATION AND INSTALLATION OF A SURFACE CONTAINMENT LAYER, WITH THE ADDITION OF



SUBSURFACE CONTAINMENT. THE CONTAINMENT SYSTEM FOR ALTERNATIVE 3 WOULD CONSIST OF AN UNDERLYING CONFINEMENT LAYER AND LATERAL CUTOFF WALLS INSTALLED AROUND THE PERIPHERY OF THE BULK WASTES, IN ADDITION TO THE SURFACE COVER OR CAP. A CONTINUOUS SURFACE AND SUBSURFACE CONTAINMENT SYSTEM WOULD MINIMIZE CONTAMINANT MIGRATION RESULTING FROM LATERAL MIGRATION OF GROUNDWATER THROUGH THE BULK WASTES. IT WOULD ALSO REDUCE SURFACE RELEASES OF CONTAMINANTS AND CONTAMINANT MIGRATION DUE TO PERCOLATION OF PRECIPITATION AND SNOWMELT THROUGH THE BULK WASTES. THE SUBSURFACE CONTAINMENT SYSTEM COULD BE INSTALLED BY DRILLING THROUGH THE WASTES AND INJECTING A CONFINING LAYER AROUND AND BENEATH THE ENTIRE QUARRY.

ALTERNATIVE 4: IN SITU TREATMENT

UNDER ALTERNATIVE 4, THE CONTAMINATED MATERIALS WOULD BE SOLIDIFIED IN SITU BY MIXING THEM WITH A CEMENTITIOUS MATERIAL TO FORM A SOLID MASS OR BY VITRIFYING THEM WITH AN ELECTRICAL CURRENT TO FORM A GLASS-LIKE MATRIX. THE RESULTANT WASTE WOULD LIMIT SURFACE RELEASES, PERCOLATION, AND LATERAL AND DOWNWARD MIGRATION OF CONTAMINANTS. THE EFFECTIVENESS OF IN SITU TREATMENT CANNOT BE GUARANTEED DUE TO UNCERTAINTIES ASSOCIATED WITH VERIFYING TREATMENT SUCCESS AND ENSURING THE INTEGRITY OF THE SOLIDIFIED WASTE OVER TIME. IF CEMENTATION WERE USED, COMPLETE MIXING AND STABILIZATION WOULD BE DIFFICULT TO ENSURE BECAUSE THE BULK WASTES EXTEND OVER A SIGNIFICANT AREA AND DEPTH AND INCLUDE PROCESS EQUIPMENT AND OTHER UNWIELDY DEBRIS. IN SITU VITRIFICATION IS GENERALLY FEASIBLE ONLY IF THE WASTES CONTAIN LESS THAN 5 PERCENT METAL BY WEIGHT AND IF LESS THAN 90 PERCENT OF THE LINEAR SEPARATION BETWEEN ELECTRODES IS OCCUPIED BY METAL. IN SITU VITRIFICATION IS INFEASIBLE BECAUSE OF THE METAL DEBRIS, E.G., DRUMS, PROCESS EQUIPMENT, AND BUILDING RUBBLE, SCATTERED THROUGHOUT THE QUARRY.

ALTERNATIVE 5: EXPEDITED EXCAVATION WITH TEMPORARY STORAGE AT THE CHEMICAL PLANT AREA

UNDER ALTERNATIVE 5, THE BULK WASTES WOULD BE EXCAVATED FROM THE QUARRY AND TRANSPORTED ALONG A DEDICATED HAUL ROAD TO THE CHEMICAL PLANT AREA. THERE, THEY WOULD BE UNLOADED AND TEMPORARILY STORED IN AN ENGINEERED FACILITY PENDING A FINAL DECISION ON DISPOSAL OF ALL WASTES GENERATED BY REMEDIATING THE WELDON SPRING SITE. TRANSPORTATION ACTIVITIES AND CONSTRUCTION AND MAINTENANCE OF THE TEMPORARY STORAGE FACILITY WOULD BE

CARRIED OUT IN A MANNER THAT WOULD MINIMIZE POTENTIAL RELEASES OF CONTAMINANTS TO THE ENVIRONMENT. LIMITED TREATMENT WOULD BE CONDUCTED, AS APPROPRIATE, TO FACILITATE IMPLEMENTATION (E.G., POST-EXCAVATION DEWATERING TO FACILITATE WASTE TRANSPORT AND STORAGE CONTROL). SUBSEQUENT TREATMENT AND/OR DISPOSAL WOULD BE ADDRESSED IN CONJUNCTION WITH OTHER ON-SITE MATERIALS AFTER COMPLETION OF THE RI/FS-EIS PROCESS AND APPROVAL OF THE RECORD OF DECISION FOR REMEDIATION OF THE CHEMICAL PLANT AREA.

A VARIATION OF THIS ALTERNATIVE WAS CONSIDERED AT THE PRELIMINARY



ANALYSIS STAGE, I.E., EXCAVATION AND REPLACEMENT OF THE BULK WASTES BACK INTO THE QUARRY FOR TEMPORARY STORAGE AFTER CHEMICAL SEALANT OR A LINER HAD BEEN PLACED IN THE QUARRY. HOWEVER, TECHNICAL DIFFICULTIES ASSOCIATED WITH COVER AND SEAL EMPLACEMENT WOULD COMPROMISE THE EFFECTIVENESS OF THIS OPTION, AND PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT COULD NOT BE ENSURED. IN ADDITION, THE AVAILABILITY OF LAND AT THE QUARRY FOR STAGING IS EXTREMELY LIMITED DUE TO CONSTRAINTS IMPOSED BY OWNERSHIP AND TOPOGRAPHY. THEREFORE, STORAGE OF THE REQUIRED VOLUME OF MATERIAL PENDING PREPARATION OF THE QUARRY FOR WASTE EMPLACEMENT WOULD BE INFEASIBLE. THUS, THIS VARIATION WAS NOT CONSIDERED FURTHER.

ALTERNATIVE 6: DELAYED ACTION PENDING THE RECORD OF DECISION FOR THE SITE

UNDER ALTERNATIVE 6, NO RESPONSE ACTION WOULD BE TAKEN WITH RESPECT TO THE QUARRY BULK WASTES UNTIL THE REMEDY IS SELECTED FOR THE ENTIRE WELDON SPRING SITE. THUS, THE BULK WASTES WOULD REMAIN IN THEIR CURRENT CONDITION FOR THE SHORT TERM.

EVALUATION OF PRELIMINARY ALTERNATIVES

MIGRATION CONTROL AT THE QUARRY (VIA CONTAINMENT) IS THE PRIMARY EMPHASIS OF ALTERNATIVES 2 AND 3, WHEREAS SOURCE CONTROL (VIA EXCAVATION AND/OR TREATMENT) IS THE PRIMARY EMPHASIS OF ALTERNATIVES 4 AND 5. ALTERNATIVE 6 (DELAYED ACTION) IS ESSENTIALLY THE SAME AS ALTERNATIVE 1 (NO ACTION) IN THE SHORT TERM. FOR PURPOSES OF EVALUATING ALTERNATIVES, ALTERNATIVE 6 IS EXPECTED TO BE SIMILAR TO ONE OF THE ACTION ALTERNATIVES (I.E., ALTERNATIVES 2 THROUGH 5) IN THE LONG TERM. HOWEVER, THIS WOULD DEPEND UPON THE ACTION SELECTED FOLLOWING THE DELAY.

EACH OF THE ACTION ALTERNATIVES WOULD REQUIRE VARIOUS SUPPORT ACTIVITIES PRIOR TO IMPLEMENTATION. THESE ACTIVITIES INCLUDE (1) DESIGN AND CONSTRUCTION OF STAGING AND SUPPORT AREAS, (2) PROCUREMENT OF APPROPRIATE EQUIPMENT, AND (3) DEVELOPMENT OF PLANNING AND OPERATIONAL CONTROLS TO MINIMIZE CONTAMINANT RELEASES. IN ADDITION, THE INSTITUTIONAL CONTROLS THAT NOW EXIST AT THE QUARRY, I.E., DOE OWNERSHIP, FENCES AND LOCKED GATES, AND MONITORING, ARE IMPLICITLY INCLUDED AS SUPPORT ACTIVITIES FOR THE ALTERNATIVES, AS APPROPRIATE. UNDER THE ACTION ALTERNATIVES, THESE CONTROLS WOULD BE UPGRADED AS

NEEDED. FOR EXAMPLE, CERTAIN PORTIONS OF THE FENCE AND GATES WOULD BE REPAIRED, ADDITIONAL SIGNS WOULD BE POSTED, AND MONITORING WOULD INCREASE.

THESE PRELIMINARY ALTERNATIVES WERE SCREENED IN THE FS ACCORDING TO THE THREE SCREENING CRITERIA PROVIDED IN THE NCP: EFFECTIVENESS, IMPLEMENTABILITY, AND COST. EFFECTIVENESS IS DEFINED AS THE ABILITY OF AN ALTERNATIVE TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT IN BOTH THE SHORT TERM AND THE LONG TERM. THE REDUCTION OF CONTAMINANT TOXICITY, MOBILITY, OR VOLUME IS CONSIDERED A MEASURE OF EFFECTIVENESS.



IMPLEMENTABILITY IS DEFINED AS THE TECHNICAL FEASIBILITY, RESOURCE AVAILABILITY, AND ADMINISTRATIVE FEASIBILITY (I.E., ACCEPTABILITY) OF AN ALTERNATIVE. COSTS CAN BE CONSIDERED ON A RELATIVE BASIS AT THE SCREENING STAGE BUT CANNOT BE THE SOLE REASON FOR ELIMINATING AN ALTERNATIVE FROM CONSIDERATION.

RESULTS OF THE SCREENING OF PRELIMINARY ALTERNATIVES ARE PRESENTED IN TABLE 7. BASED ON THIS SCREENING, THREE FINAL ALTERNATIVES WERE IDENTIFIED FOR MANAGING THE QUARRY BULK WASTES:

* ALTERNATIVE 1: NO ACTION.

* ALTERNATIVE 5: EXPEDITED EXCAVATION WITH TEMPORARY STORAGE AT THE CHEMICAL PLANT AREA.

* ALTERNATIVE 6: DELAYED ACTION PENDING THE RECORD OF DECISION FOR THE SITE.

#SCAF
SUMMARY OF COMPARATIVE ANALYSIS OF FINAL ALTERNATIVES

EVALUATION OF THE FINAL ALTERNATIVES

THE FINAL ALTERNATIVES FOR MANAGING THE QUARRY BULK WASTES WERE EVALUATED ACCORDING TO THE NINE CRITERIA PROVIDED IN THE NCP FOR FINAL REMEDIAL ACTIONS, AS APPROPRIATE TO THIS INTERIM ACTION. THESE EVALUATION CRITERIA ARE:

* THRESHOLD CRITERIA -- OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT AND COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS.

* PRIMARY BALANCING CRITERIA -- LONG-TERM EFFECTIVENESS AND PERMANENCE; REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT; SHORT-TERM EFFECTIVENESS; IMPLEMENTABILITY; AND COST.

* MODIFYING CRITERIA -- STATE ACCEPTANCE AND COMMUNITY ACCEPTANCE.

NO ACTION

CONSISTENT WITH EPA GUIDANCE, THE NON-ACTION ALTERNATIVE WAS CARRIED THROUGH THE DETAILED EVALUATION PHASE OF THE REMEDIAL ACTION DECISION MAKING PROCESS TO PROVIDE A BASELINE FOR COMPARISON WITH THE REMAINING FINAL ALTERNATIVES. THE NO-ACTION ALTERNATIVE WOULD NOT BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. CONTAMINANT TOXICITY, MOBILITY, AND VOLUME WOULD NOT BE REDUCED. THE NO-ACTION ALTERNATIVE WOULD NOT BE EFFECTIVE IN EITHER THE SHORT TERM OR THE LONG TERM. RADON RELEASES



FROM THE UNCONTROLLED WASTES, WHICH HAVE EXCEEDED REGULATORY LIMITS, WOULD CONTINUE AT PRESENT LEVELS AS WOULD RELEASES OF OTHER MATERIALS. THE NO-ACTION ALTERNATIVE WOULD NOT PROVIDE A PERMANENT REMEDIAL ACTION SOLUTION AT THE QUARRY.

TIMELINESS, ENGINEERING CONTROLS, CONSTRUCTION AND OPERATIONAL FACTORS, WASTE HANDLING AND IMPLEMENTATION REQUIREMENTS, AND COSTS DO NOT APPLY TO THE NO-ACTION ALTERNATIVE.

EXPEDITED EXCAVATION WITH TEMPORARY STORAGE AT THE CHEMICAL PLANT AREA

UNDER THE EXPEDITED EXCAVATION AND TEMPORARY STORAGE ALTERNATIVE, THE BULK WASTES WOULD BE EXCAVATED FROM THE QUARRY WITH STANDARD EQUIPMENT AND PRACTICES, THEN TRANSPORTED ALONG A DEDICATED HAUL ROAD TO THE CHEMICAL PLANT AREA OF THE WELDON SPRING SITE. THERE, THE WASTES WOULD BE UNLOADED AND TEMPORARILY STORED IN AN ENGINEERED FACILITY PENDING A FINAL DECISION ON DISPOSAL OF ALL WASTES GENERATED BY REMEDIATING THE WELDON SPRING SITE. THE STORAGE FACILITY WOULD BE CONSTRUCTED AND MAINTAIN IN A MANNER THAT WOULD MINIMIZE POTENTIAL RELEASES. LIMITED TREATMENT MAY BE CONDUCTED AS APPROPRIATE TO FACILITATE IMPLEMENTATION (E.G., DEWATERING COULD BE USED AFTER EXCAVATION TO FACILITATE WASTE TRANSPORT AND STORAGE). THIS ALTERNATIVE WOULD EXPEDITE CLEANUP WITHOUT ADVERSELY AFFECTING ULTIMATE WASTE MANAGEMENT DECISIONS FOR THE WELDON SPRING SITE OR LIMITING THE CHOICE OF REASONABLE ALTERNATIVES. SUBSEQUENT TREATMENT AND/OR DISPOSAL OF THE BULK WASTES WOULD BE ADDRESSED IN CONJUNCTION WITH OTHER ON-SITE MATERIALS IN THE RI/FS-EIS THAT IS BEING PREPARED FOR REMEDIATION OF THE CHEMICAL PLANT AREA.

THE TOTAL VOLUME OF MATERIALS THAT WOULD BE HANDLED IF THIS ALTERNATIVE WERE IMPLEMENTED IS ESTIMATED TO BE ABOUT 110,000 M(3) (140,000 YD(3)). THIS VOLUME INCLUDES MATERIALS RESULTING FROM PREPARATORY CLEARING AND GRUBBING ACTIVITIES AT THE QUARRY, THE EXCAVATED BULK WASTES, UNCONTAMINATED MATERIALS EXCAVATED ALONG WITH THE WASTES, EXPANSION OF EXCAVATED MATERIALS FOLLOWING THEIR REMOVAL FROM THE QUARRY, AND A 15 PERCENT CONTINGENCY FACTOR. AN ESTIMATED 15 MONTHS WOULD BE REQUIRED TO IMPLEMENT THIS ALTERNATIVE AT A COST OF ABOUT $11 MILLION. THESE FIGURES, HOWEVER, ARE PRELIMINARY AND MAY INCREASE AS ENGINEERING DESIGN IS COMPLETED. INSTITUTIONAL CONTROLS WOULD CONSIST OF CONTINUED SITE OWNERSHIP, MONITORING, AND IMPROVEMENT AND EXTENSION OF EXISTING PHYSICAL BARRIERS AS NEEDED (E.G., FOR THE HAUL ROAD AND QUARRY SUPPORT

AREA). ENGINEERING CONTROLS WOULD BE IMPLEMENTED TO MINIMIZE POTENTIAL RELEASES OF CONTAMINANTS (E.G., RADON AND FUGITIVE DUSTS) IN ORDER TO ENSURE PROTECTION OF THE WORKERS, THE PUBLIC, AND THE ENVIRONMENT DURING THE ACTION PERIOD. THESE CONTROLS INCLUDE LIMITING THE EXTENT OF THE WORK AREA AND WETTING AND/OR COVERING EXPOSED SURFACES AT THE QUARRY; CONTROLLING THE SPEED OF TRANSPORT VEHICLES ON THE HAUL ROAD; AND UTILIZING LINERS, RUN-ON/RUNOFF CONTROL SYSTEMS, AND COVERS FOR THE TEMPORARY STORAGE FACILITY AT THE CHEMICAL PLANT AREA.

THE EXPEDITED-ACTION ALTERNATIVE WOULD BE TIMELY AND WOULD SUPPORT



OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT AT THE QUARRY IN BOTH THE SHORT TERM AND THE LONG TERM. THIS ALTERNATIVE WOULD (1) REDUCE CONTAMINANT TOXICITY, MOBILITY, AND VOLUME THROUGH SOURCE CONTROL; (2) REDUCE CONTAMINANT MOBILITY OF THE EXCAVATED WASTES BY PLACING THEM IN CONTROLLED STORAGE IN THE CHEMICAL PLANT AREA; AND (3) FACILITATE SUBSEQUENT RESPONSE ACTIVITIES AT THE WELDON SPRING SITE, INCLUDING FOLLOW-ON QUARRY REMEDIATION, WASTE CHARACTERIZATION, AND COMPREHENSIVE WASTE MANAGEMENT DECISIONS. HENCE, THIS ALTERNATIVE IS CONSISTENT WITH, AND WOULD CONTRIBUTE TO, A PERMANENT SOLUTION AT THE QUARRY AND THE EFFICIENT PERFORMANCE OF OVERALL REMEDIAL ACTIONS BEING PLANNED FOR THE SITE. FURTHERMORE, IT COULD BE IMPLEMENTED WITH READILY AVAILABLE EQUIPMENT AND STANDARD ENGINEERING PROCEDURES. IT WOULD ALSO BE COST EFFECTIVE BECAUSE IT WOULD LIMIT BOTH INFLATIONARY EFFECTS AND POTENTIAL INCREASED CLEANUP EFFORTS THAT WOULD RESULT IF CONTAMINATION AT THE QUARRY SPREAD BEFORE A RESPONSE WAS IMPLEMENTED.

DELAYED ACTION PENDING THE RECORD OF DECISION FOR THE SITE

UNDER THIS ALTERNATIVE, NO ACTION WOULD BE TAKEN FOR THE QUARRY BULK WASTES UNTIL A DECISION WAS MADE REGARDING THE ULTIMATE DISPOSITION OF THE ENTIRE WELDON SPRING SITE. RATHER THAN BEING EXPEDITED, REMEDIAL ACTION AT THE QUARRY WOULD BE POSTPONED UNTIL THE SITE RECORD OF DECISION WAS APPROVED. THIS APPROVAL WOULD FOLLOW ISSUANCE OF THE RI/FS-EIS CURRENTLY BEING PREPARED. HENCE, THIS ALTERNATIVE IS SIMILAR TO THE NO-ACTION ALTERNATIVE IN THE SHORT TERM. THE DELAY PERIOD IS EXPECTED TO LAST TWO TO FIVE YEARS.

IN THE LONGER TERM, WHEN THE RESPONSE WAS IMPLEMENTED FOLLOWING THE DELAY PERIOD, MANY OF THE CONSIDERATIONS FOR THIS ALTERNATIVE COULD BE SIMILAR TO THOSE FOR THE EXPEDITED-ACTION ALTERNATIVE, I.E., IF AN EXCAVATION ALTERNATIVE WERE EVENTUALLY SELECTED PURSUANT TO THE RECORD OF DECISION. THAT IS, WASTE HANDLING AND IMPLEMENTATION REQUIREMENTS AND ENGINEERING AND INSTITUTIONAL CONTROLS WOULD BE SIMILAR TO THOSE FOR THE EXPEDITED-EXCAVATION ALTERNATIVE. DELAYING INITIATION OF A RESPONSE ACTION WOULD RESULT IN CONTINUED MIGRATION OF CONTAMINATION FROM THE QUARRY, AND THIS COULD ADVERSELY IMPACT HUMAN HEALTH AND THE ENVIRONMENT. THE COST OF IMPLEMENTING THIS ALTERNATIVE IS EXPECTED TO INCREASE BECAUSE OF INFLATION; THE TOTAL COST OF COMPREHENSIVE QUARRY REMEDIATION COULD INCREASE EVEN FURTHER IF THE EXTENT OF CONTAMINATION AND THE RESULTANT SCOPE OF REQUIRED CLEANUP INCREASED AS A RESULT OF THE

DELAY.

COMPARISON TO THE NINE EVALUATION CRITERIA

THRESHOLD CRITERIA

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT.

OF THE THREE FINAL ALTERNATIVES, THE EXPEDITED-ACTION ALTERNATIVE WOULD PROVIDE THE GREATEST SHORT-TERM LEVEL OF PROTECTION OF HUMAN HEALTH AND



THE ENVIRONMENT. IT WOULD CONTROL THE PRIMARY SOURCE OF ONGOING CONTAMINANT RELEASES VIA AIR AND GROUNDWATER AND MAINTAIN THE WASTES IN CONTROLLED STORAGE AT A FACILITY ENGINEERED TO PREVENT CONTAMINANT RELEASES TO THE ENVIRONMENT. THE NO-ACTION ALTERNATIVE WOULD NOT BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT IN EITHER THE SHORT TERM OR LONG TERM SINCE RELEASES WOULD CONTINUE UNMITIGATED. WHILE THE DELAYED-ACTION ALTERNATIVE WOULD NOT PROVIDE SUCH PROTECTION IN THE SHORT TERM, IT IS EXPECTED THAT AT SUCH TIME AS THE FINAL QUARRY REMEDIAL ACTION DECISION IS MADE, A REMEDY PROVIDING A SIMILAR LEVEL OF LONG-TERM PROTECTION WOULD BE SELECTED.

COMPLIANCE WITH ARARS.

THE ONLY IDENTIFIED REQUIREMENT THAT IS CURRENTLY NOT BEING MET AND IS APPLICABLE TO THE NO-ACTION AND DELAYED-ACTION ALTERNATIVES IS THE STATE REQUIREMENT OF 1 PCI/L OUTSIDE A CONTROLLED AREA. SINCE RADON-222 LEVELS CURRENTLY EXCEED THIS LIMIT AT THE QUARRY FENCE LINE, THESE ALTERNATIVES WOULD NOT COMPLY WITH THIS REQUIREMENT. WHILE THE EXPEDITED-RESPONSE ACTION COULD NOT MEET THIS REQUIREMENT DURING IMPLEMENTATION, THE REQUIREMENT COULD BE ACHIEVED UPON COMPLETION OF THE REMEDIAL ACTION BOTH AT THE QUARRY AND AT THE TEMPORARY STORAGE AREA.

RCRA SUBTITLE C REQUIREMENTS FOR CLOSURE OF A LANDFILL ARE ALSO CONSIDERED RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE NO-ACTION ALTERNATIVE, BUT THE ALTERNATIVE WOULD NOT MEET THIS REQUIREMENT. SINCE THE EXPEDITED-ACTION ALTERNATIVE IS NOT CONSIDERED THE FINAL REMEDIAL ACTION FOR THE QUARRY, LANDFILL CLOSURE REQUIREMENTS ARE NOT CONSIDERED TO BE RELEVANT AND APPROPRIATE. EVEN IF RCRA CLOSURE REQUIREMENTS WERE CONSIDERED RELEVANT AND APPROPRIATE TO EXCAVATION AT THE QUARRY, THEY COULD PROPERLY BE WAIVED PURSUANT TO SECTION 121(D)(4)(A). THIS IS BECAUSE THE QUARRY BULK WASTE REMEDIAL ACTION IS ONLY PART OF A TOTAL REMEDIAL ACTION WHICH WILL ATTAIN THAT STANDARD UPON COMPLETION. THE APPLICABILITY AND RELEVANCE AND APPROPRIATENESS OF THE CLOSURE REQUIREMENTS TO THE DELAYED-ACTION ALTERNATIVE WOULD BE DETERMINED AT THE TIME THE FINAL REMEDY SELECTION DECISION IS MADE.

THE EXPEDITED-RESPONSE ACTION CAN BE CONDUCTED IN COMPLIANCE WITH OTHER FEDERAL AND STATE ARARS.

PRIMARY BALANCING CRITERIA

LONG-TERM EFFECTIVENESS AND PERMANENCE

THE EXPEDITED-ACTION AND DELAYED-ACTION ALTERNATIVES PROVIDE SIMILAR LEVELS OF LONG-TERM EFFECTIVENESS AND PERMANENCE. THE NO-ACTION ALTERNATIVE WOULD NOT BE EFFECTIVE OVER THE LONG TERM AND WOULD NOT PROVIDE A PERMANENT REMEDY FOR THE QUARRY.

REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT



THE NON-ACTION ALTERNATIVE WOULD NOT REDUCE THE TOXICITY, MOBILITY, OR VOLUME OF THE WASTES THROUGH TREATMENT. THE EXPEDITED-ACTION AND DELAYED-ACTION AND DELAYED-ACTION ALTERNATIVES ARE EXPECTED TO PROVIDE A COMPARABLE DEGREE OR REDUCTION IN WASTE MOBILITY BY REMOVING THE BULK WASTES TO A SEPARATE AREA OF THE SITE WHERE STORAGE COULD BE CONTROLLED. HOWEVER, THE REDUCTION IN WASTE MOBILITY WOULD NOT BE TIMELY IN THE DELAYED-ACTION ALTERNATIVE BECAUSE OF THE DELAY PERIOD. THE WASTES WOULD BE SUBSEQUENTLY TREATED AND/OR DISPOSED OF PURSUANT TO THE DECISIONS MADE IN THE RI/FS-EIS CURRENTLY BEING DEVELOPED FOR THE WELDON SPRING SITE. NEITHER ALTERNATIVE WOULD REDUCE THE TOXICITY OR VOLUME OF THE BULK WASTES.

SHORT-TERM EFFECTIVENESS

THE EXPEDITED-ACTION ALTERNATIVE WOULD PROVIDE A TIMELY RESPONSE TO ON-GOING RELEASES OF CONTAMINANTS TO THE ENVIRONMENT. THE NO-ACTION AND DELAYED-ACTION ALTERNATIVES WOULD NOT BE EFFECTIVE IN THE SHORT TERM.

IMPLEMENTABILITY

THE EXPEDITED-ACTION AND DELAYED-ACTION ALTERNATIVES ARE BOTH TECHNICALLY AND ADMINISTRATIVELY FEASIBLE. IMPLEMENTABILITY DOES NOT APPLY TO THE NO-ACTION ALTERNATIVE.

COST

THE EXPEDITED-ACTION ALTERNATIVE IS ESTIMATED TO COST ABOUT 411 MILLION. THE COST OF IMPLEMENTING THE DELAYED-ACTION ALTERNATIVE CANNOT BE ESTIMATED AT THIS TIME. HOWEVER, ASSUMING THE DELAYED ACTION IS SIMILAR TO THE PROPOSED EXPEDITED ACTION, COSTS WOULD BE SOMEWHAT HIGHER BECAUSE OF INFLATION. FURTHERMORE, THE TOTAL COST OF COMPREHENSIVE QUARRY REMEDIATION COULD INCREASE EVEN FURTHER IF THE EXTENT OF CONTAMINATION AND THE RESULTANT SCOPE OF REQUIRED CLEANUP EFFORTS INCREASED AS A RESULT OF THE DELAY. THE NO-ACTION ALTERNATIVE HAS NO COST.

MODIFYING CRITERIA

STATE ACCEPTANCE

THE STATE OF MISSOURI SUPPORTS THE SELECTED ALTERNATIVE.

COMMUNITY ACCEPTANCE

A PUBLIC COMMENT PERIOD WAS HELD FROM MARCH 5, 1990, THROUGH APRIL 9, 1990. IN ADDITION, A PUBLIC MEETING WAS HELD ON MARCH 29, 1990, TO EXPLAIN THE PREFERRED REMEDY AND ELICIT COMMENTS FROM THE PUBLIC. PUBLIC COMMENTS RECEIVED DURING THE COMMENT PERIOD INDICATE THAT THE MAJORITY OF THE COMMUNITY DIRECTLY IMPACTED BY THIS ACTION (I.E., RESIDENTS OF ST. CHARLES COUNTY) SUPPORT THE EXPEDITED-ACTION ALTERNATIVE. WITH THE EXCEPTION OF MEMBERS OF THE COALITION FOR THE



ENVIRONMENT, CITIZENS IN NEIGHBORING COUNTIES PROVIDED NO COMMENTS ON THE PROPOSED ACTION. MEMBERS OF THE COALITION FOR THE ENVIRONMENT, WHO RESIDE IN ST. LOUIS COUNTY, OPPOSE THE EXPEDITED-ACTION ALTERNATIVE CITING A LACK OF CHARACTERIZATION DATA AND ENGINEERING DETAIL IN THE RI/FS AND SUPPORTING DOCUMENTS. THIS ORGANIZATION STATED THAT MORE INFORMATION IS NEEDED BEFORE ONE OF THE ALTERNATIVES IS SELECTED. NO GROUP OR INDIVIDUAL SUPPORTED ANY OF THE REJECTED ALTERNATIVES. RESPONSES TO THE COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD ARE INCLUDED IN THE RESPONSIVENESS SUMMARY, WHICH WAS PREPARED AS A SEPARATE DOCUMENT. A SUMMARY OF THE MAJOR ISSUES RAISED DURING THE PUBLIC COMMENT PERIOD IS INCLUDED IN THIS RECORD OF DECISION.

#SR
SELECTED REMEDY

BASED ON AN EVALUATION OF THE FINAL ALTERNATIVES FOR MANAGING THE QUARRY BULK WASTES, EXPEDITED ACTION HAS BEEN SELECTED AS THE REMEDY. UNDER THIS ALTERNATIVE, THE BULK WASTES WILL BE EXCAVATED FROM THE QUARRY, TRANSPORTED ALONG A DEDICATED HAUL ROAD, AND PLACED IN CONTROLLED STORAGE IN THE CHEMICAL PLANT AREA PENDING A FINAL DECISION ON DISPOSAL OF ALL WASTES GENERATED BY REMEDIATING THE WELDON SPRING SITE.

THE EXPEDITED-ACTION ALTERNATIVE REPRESENTS THE BEST BALANCE AMONG THE EVALUATION CRITERIA FOR REMEDIAL ACTIONS. THE NO-ACTION AND DELAYED-ACTION ALTERNATIVES WOULD NOT SUPPORT A PERMANENT SOLUTION DURING THE SHORT TERM, AND THEY WOULD HINDER THE DECISION MAKING PROCESS FOR, AND IMPLEMENTATION OF, OVERALL SITE CLEANUP. TIMELINESS, IMPLEMENTABILITY, AND COST DO NOT APPLY TO THE NO-ACTION ALTERNATIVE. ALTHOUGH IMPLEMENTATION OF THE DELAYED ACTION ALTERNATIVE MIGHT BE SIMILAR TO THAT OF THE CURRENTLY PREFERRED ALTERNATIVE DURING THE ACTION PERIOD, IT IS NOT CONSIDERED TIMELY BECAUSE OF THE DELAY. DELAYING CLEANUP COULD ALSO INCREASE THE CONTAMINANT MIGRATION PROBLEM WHICH WOULD NEGATIVELY IMPACT OVERALL PROTECTIVENESS AND COST EFFECTIVENESS.

EXPEDITED EXCAVATION OF THE BULK WASTES WOULD PROTECT HUMAN HEALTH AND THE ENVIRONMENT BY (1) CONTROLLING THE PRIMARY SOURCE OF ONGOING CONTAMINANT RELEASES VIA AIR AND GROUNDWATER AND (2) MAINTAINING THE WASTES IN CONTROLLED STORAGE AT A FACILITY ENGINEERED TO PREVENT CONTAMINANT RELEASES TO THE ENVIRONMENT. EXPEDITED EXCAVATION WOULD

ALSO PROMOTE THE EFFECTIVENESS OF SITE CLEANUP BY FACILITATING DETAILED CHARACTERIZATION OF (1) THE QUARRY SUBSURFACE TO ADDRESS COMPLETE FOLLOW-ON REMEDIATION, AND (2) THE BULK WASTES TO SUPPORT COMPREHENSIVE WASTE MANAGEMENT DECISIONS FOR THE PROJECT.

#SD
STATUTORY DETERMINATIONS

CONSISTENT WITH THE STATUTORY REQUIREMENTS OF SECTION 121 OF CERCLA, AS



AMENDED, REMEDIAL ACTIONS SHOULD BE SELECTED THAT:

* ARE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.

* COMPLY WITH ARARS.

* UTILIZE PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE.

* SATISFY THE PREFERENCE FOR TREATMENT WHICH, AS A PRINCIPLE ELEMENT, REDUCES TOXICITY, MOBILITY, AND VOLUME.

THE QUARRY BULK WASTE REMEDIAL ACTION IS ONLY ONE OF SEVERAL ACTIONS THAT WILL BE TAKEN TO REMEDIATE THE WELDON SPRING SITE (SEE FIGURE 5). THE MANNER IN WHICH THIS FOCUSED ACTION SATISFIES THESE FIVE REQUIREMENTS IS DISCUSSED IN THE FOLLOWING SUBSECTIONS.

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

THE SELECTED REMEDY IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT BY (1) CONTROLLING THE PRIMARY SOURCE OF ONGOING CONTAMINANT RELEASES FROM THE QUARRY VIA AIR AND GROUNDWATER AND (2) MAINTAINING THE WASTES IN CONTROLLED STORAGE AT A FACILITY ENGINEERED TO PREVENT RELEASE OF CONTAMINANTS TO THE ENVIRONMENT. ALTHOUGH THE QUARRY BULK WASTES DO NOT POSE A SIGNIFICANT RISK TO HUMAN HEALTH AND THE ENVIRONMENT IN THE SHORT TERM, THE CONTINUED PRESENCE OF THE BULK WASTES COULD POSE SIGNIFICANT THREATS IN THE FUTURE.

THE BULK WASTES CONTAIN ELEVATED CONCENTRATIONS OF BOTH RADIOACTIVE AND CHEMICAL CONTAMINANTS, AND THE LIMESTONE UNDERLYING THE QUARRY CONTAINS FRACTURES AND FISSURES THAT CONSTITUTE POTENTIAL PATHWAYS FOR CONTAMINANT MIGRATION. CONTAMINANTS ARE CURRENTLY MIGRATING INTO THE GROUNDWATER BENEATH THE QUARRY, AND RADON GAS CONCENTRATIONS AND GAMMA EXPOSURE RATES WITHIN THE QUARRY AND AT THE FENCE LINE ARE ELEVATED ABOVE BACKGROUND LEVELS.

IN ADDITION, SOME TYPES OF VEGETATION IN THE VICINITY CONTAIN ELEVATED LEVELS OF RADIOACTIVITY. THIS CONTAMINATION DOES NOT POSE AN IMMEDIATE RISK BECAUSE SITE ACCESS IS CONTROLLED, THE NEARBY ENVIRONMENT IS CONTINUOUSLY MONITORED, AND CORRECTIVE ACTIONS TO PROTECT HUMAN HEALTH

AND THE ENVIRONMENT WOULD BE IMPLEMENTED IF WARRANTED. HOWEVER, IF ADMINISTRATIVE CONTROL OF THE QUARRY WERE LOST AT SOME POINT IN THE FUTURE, EXPOSURE TO THE BULK WASTES COULD POTENTIALLY RESULT IN EXCESSIVE HEALTH RISKS TO PERSONS FREQUENTLY ENTERING IT.

PROCEDURES TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT WILL BE IMPLEMENTED DURING THE QUARRY BULK WASTE REMEDIAL ACTION. THE ENVIRONMENTAL PATHWAY OF MOST CONCERN IS ATMOSPHERIC RELEASES. EXTENSIVE CONTROL MEASURES WILL BE IMPLEMENTED DURING ALL PHASES OF THE ACTION THAT COULD CREATE AIRBORNE EMISSIONS. DURING EXCAVATION OF THE WASTES,



EMISSIONS WILL BE CONTROLLED BY WATER SPRAYS, FOAMS, AND TARPAULINS, AS NEEDED. THE WASTES WILL BE TRANSPORTED TO THE CHEMICAL PLANT AREA IN TRUCKS ALONG A DEDICATED HAUL ROAD. CURRENT PLANS ARE TO PACKAGE THE WASTES IN CONTAINERS TO ENSURE MINIMAL RELEASES. DUST CONTROL MEASURES SIMILAR TO THOSE AT THE QUARRY WILL BE USED WHILE THE WASTES ARE BEING UNLOADED AT THE TEMPORARY STORAGE AREA. FINALLY, ALL WASTES SUSCEPTIBLE TO WINDBLOWN EROSION OR RELEASE OF RADON GAS WILL BE COVERED AS SOON AS PRACTICAL FOLLOWING PLACEMENT IN THE TEMPORARY STORAGE AREA. THESE MEASURES WILL ENSURE MINIMAL ATMOSPHERIC RELEASES AS A RESULT OF IMPLEMENTING THIS ACTION AND THUS BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.

THE SELECTED REMEDY FURTHER PROTECTS HUMAN HEALTH AND THE ENVIRONMENT IN THAT IT SUPPORTS OVERALL REMEDIATION OF THE WELDON SPRING SITE BY FACILITATING FURTHER INVESTIGATIONS AT THE QUARRY AREA. THESE INVESTIGATIONS ARE ESSENTIAL FOR EVALUATING THE VARIOUS RESPONSE ACTION ALTERNATIVES FOR THE QUARRY. AN UNDERSTANDING OF THE NATURE AND EXTENT OF FRACTURE JOINTS AND FISSURES AND ASSOCIATED SOIL AND GROUNDWATER CONTAMINATION CAN BE ESTABLISHED ONLY AFTER THE BULK WASTES HAVE BEEN REMOVED. HENCE, THE PROPOSED REMOVAL OF BULK WASTES FROM THE QUARRY WOULD FACILITATE THE DEVELOPMENT OF A COMPREHENSIVE PLAN TO ADDRESS THE ISSUE OF SUBSURFACE REMEDIATION IN THIS AREA.

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

THE SELECTED REMEDY WILL COMPLY WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, UNLESS THOSE REQUIREMENTS HAVE BEEN PROPERLY WAIVED IN ACCORDANCE WITH CERCLA, AND WILL BE PERFORMED CONSISTENT WITH ALL PERTINENT DOE ORDERS AS SET FORTH BELOW. THE ARARS ARE PRESENTED BELOW ACCORDING TO LOCATION-SPECIFIC, ACTION-SPECIFIC, AND CONTAMINANT-SPECIFIC REQUIREMENTS. THE EXCAVATION, TRANSPORTATION, AND STORAGE OF THE WASTES ARE CONSIDERED TO BE ONSITE ACTIONS AND NEED ONLY COMPLY WITH THE SUBSTANTIVE REQUIREMENTS OF FEDERAL AND STATE ENVIRONMENTAL LAWS THAT ARE ARARS.

LOCATION-SPECIFIC ARARS

THE ANALYSIS OF LOCATION-SPECIFIC ARARS INCLUDED A REVIEW OF THE RESOURCE CONSERVATION AND RECOVERY ACT, THE MISSOURI HAZARDOUS WASTE

MANAGEMENT LAWS, THE NATIONAL HISTORICAL PRESERVATION ACT, THE ARCHEOLOGICAL AND HISTORIC PRESERVATION ACT, THE ARCHEOLOGICAL PROTECTION ACT, THE ENDANGERED SPECIES ACT, THE FISH AND WILDLIFE COORDINATION ACT, THE CLEAN WATER ACT, THE WILDERNESS ACT, THE WILDLIFE MANAGEMENT ACT, THE COASTAL BARRIER RESOURCES ACT, THE CLEAN AIR ACT, AND THE SURFACE MINING CONTROL AND RECLAMATION ACT AS OUTLINED IN THE CERCLA COMPLIANCE WITH OTHER LAWS MANUAL.

THE PLANNED INSTALLATION OF A 10-CM (4-IN) PIPE TO CONNECT THE QUARRY WITH AN EXISTING COUNTY WATER MAIN (FOR DECONTAMINATION, FIRE-FIGHTING



CAPABILITY, AND OTHER WATER REQUIREMENTS) COULD IMPACT CULTURAL RESOURCES. REQUIREMENTS ASSOCIATED WITH PROTECTION OF CULTURAL RESOURCES ARE APPLICABLE (I.E., NATIONAL HISTORIC PRESERVATION ACT, ARCHEOLOGICAL AND HISTORIC PRESERVATION ACT, AND ARCHEOLOGICAL RESOURCES PROTECTION ACT). CONSTRUCTION OF THE WATER LINE WILL BE COORDINATED WITH THE MISSOURI STATE HISTORIC PRESERVATION OFFICER TO ENSURE COMPLIANCE WITH THESE REQUIREMENTS.

THE PROPOSED ACTION WILL NOT IMPACT FLOODPLAINS, WETLANDS, OR SENSITIVE ECOSYSTEMS.

NO OTHER LOCATION-SPECIFIC REQUIREMENTS WERE FOUND TO BE EITHER APPLICABLE OR RELEVANT AND APPROPRIATE TO THE PROPOSED ACTION.

ACTION-SPECIFIC ARARS

THE ANALYSIS OF ACTION-SPECIFIC ARARS ADDRESSED THE FOLLOWING TASKS FOR THE QUARRY BULK WASTE REMEDIAL ACTION:

* EXCAVATION - REMOVAL OF BULK WASTES FROM THE QUARRY.

* STORAGE - TEMPORARY STORAGE IN A WASTE MANAGEMENT UNIT DEFINED AS A WASTE PILE WHICH INCLUDES SURFACE IMPOUNDMENTS FOR RUNOFF CONTROL.

PRESENTED BELOW IS A DISCUSSION OF THE ARARS FOR THESE ACTIVITIES.

EXCAVATION

REQUIREMENTS ASSOCIATED WITH THE EXCAVATION OF WASTES ARE FOUND IN RCRA CLOSURE REQUIREMENTS. A COMPLETE ANALYSIS OF CLOSURE REQUIREMENTS FOR THE QUARRY IS NOT WITHIN THE SCOPE OF THE QUARRY BULK WASTE REMEDIAL ACTION SINCE THE ACTION WILL BE COMPLETE WITH EXCAVATION OF THE BULK WASTES. THE FOLLOW-ON RESIDUAL RI/FS WILL CHARACTERIZE THE NATURE AND EXTENT OF ANY CONTAMINATION LEFT IN THE CRACKS AND FISSURES OF THE ROCK, DEVELOP RISK-BASED CLEANUP CRITERIA, AND DEFINE APPROPRIATE CLOSURE REQUIREMENTS. AS DISCUSSED PREVIOUSLY, CLOSURE REQUIREMENTS FOR THE QUARRY ARE NEITHER APPLICABLE NOR RELEVANT AND APPROPRIATE TO THE EXCAVATION PHASE OF REMEDIAL ACTION.

CLOSURE REQUIREMENTS WILL BE CONSIDERED IN MORE DETAIL IN THE FOLLOW-ON RESIDUAL RI/FS. AFTER EXCAVATION OF THE BULK WASTES, ADDITIONAL CHARACTERIZATION WORK WILL BE PERFORMED TO BETTER CHARACTERIZE THE NATURE AND EXTENT OF ANY CONTAMINATION LEFT IN THE CRACKS AND FISSURES OF THE ROCK, AND TO DEFINE APPROPRIATE CLOSURE REQUIREMENTS.

OCCUPATIONAL SAFETY AND HEALTH STANDARDS FOR WORKERS INVOLVED IN ACTIVITIES AT CERCLA SITES ARE GIVEN IN 29 CFR 1910.120. THESE REQUIREMENTS ARE NOT APPLICABLE UNDER EXEMPTIONS IN THE ATOMIC ENERGY ACT. THESE REQUIREMENTS ARE, HOWEVER, RELEVANT AND APPROPRIATE TO THIS



REMEDIAL ACTION.

STORAGE

RCRA SUBTITLE C REQUIREMENTS FOR WASTE PILES AND SURFACE IMPOUNDMENTS ARE CONSIDERED POSSIBLE ARARS FOR THE SELECTED ACTION. MISSOURI HAZARDOUS WASTE MANAGEMENT REQUIREMENTS ARE SIMILAR TO FEDERAL REQUIREMENTS, WITH SOME DIFFERENCES AS DISCUSSED BELOW. THE AREAS OF THE REGULATIONS THAT WERE EVALUATED INCLUDE THOSE FOR WASTE MANAGEMENT UNITS DEFINED AS WASTE PILES AND SURFACE IMPOUNDMENTS. THE RESPECTIVE REQUIREMENTS ARE PRESENTED IN 40 CFR 264 SUBPARTS L (WASTE PILES), K (SURFACE IMPOUNDMENTS), G (CLOSURE AND POST CLOSURE), AND F (GROUNDWATER PROTECTION).

THE RCRA DESIGN REQUIREMENTS FOR WASTE PILES ARE FOUND IN SUBPART L, SECTION 264.251. THESE REQUIREMENTS ARE RELEVANT AND APPROPRIATE TO THIS REMEDIAL ACTION. THEREFORE, THE WASTE PILE WILL BE DESIGNED IN ACCORDANCE WITH 40 CFR 264.251 TO STORE THE MATERIAL AS IF RCRA WERE APPLICABLE. THE FACILITY WILL INCLUDE A LINER, A LEACHATE COLLECTION AND REMOVAL SYSTEM, A RUN-ON CONTROL SYSTEM, A RUNOFF MANAGEMENT SYSTEM AND A COVER FOR AREAS WHICH CONTAIN PARTICULATE MATTER SUBJECT TO WIND DISPERSAL.

THE COLLECTION AND HOLDING FACILITIES WITHIN THE TEMPORARY STORAGE AREA WERE EVALUATED WITH RESPECT TO RCRA REQUIREMENTS IN SUBPART K, SECTION 264.221 AND THE MISSOURI HAZARDOUS WASTE MANAGEMENT LAWS FOR SURFACE IMPOUNDMENTS. THE STATE AND FEDERAL RCRA REQUIREMENTS FOR SURFACE IMPOUNDMENTS ARE NOT LEGALLY APPLICABLE BUT MAY BE RELEVANT AND APPROPRIATE. THE DESIGN REQUIREMENTS FOR A DOUBLE LINER SYSTEM SPECIFIED IN 40 CFR 264.221(C) ARE RELEVANT AND APPROPRIATE. HOWEVER, CONSIDERING THE EXPECTED DURATION OF STORAGE, THE CLAY LINER REQUIREMENT OF 10 CSR 25-7.264(2)(K) IS NOT APPROPRIATE. THE SOIL UNDERLYING THE PROPOSED LOCATION FOR THE TEMPORARY STORAGE AREA IS ALREADY CONTAMINATED; THE EVENTUAL REMEDY OF THE CHEMICAL PLANT AREA WILL INCLUDE REMEDIATION OF ON-SITE CONTAMINATED SOIL.

SIMILARLY, THE GROUNDWATER PROTECTION REQUIREMENTS OF 40 CFR 264 SUBPART F ARE NOT LEGALLY APPLICABLE BUT THE GROUNDWATER MONITORING REQUIREMENTS ARE CONSIDERED TO BE RELEVANT AND APPROPRIATE. THE GROUNDWATER RESPONSE REQUIREMENTS, HOWEVER, ARE NOT CONSIDERED TO BE RELEVANT AND APPROPRIATE

TO THIS REMEDIAL IMPOUNDMENTS. THE RESPECTIVE REQUIREMENTS ARE PRESENTED IN 40 CFR 264 SUBPARTS L (WASTE PILES), K (SURFACE IMPOUNDMENTS), G (CLOSURE AND POST CLOSURE), AND F (GROUNDWATER PROTECTION).

THE RCRA DESIGN REQUIREMENTS FOR WASTE PILES ARE FOUND IN SUBPART L, SECTION 264.251. THESE REQUIREMENTS ARE RELEVANT AND APPROPRIATE TO THIS REMEDIAL ACTION. THEREFORE, THE WASTE PILE WILL BE DESIGNED IN ACCORDANCE WITH 40 CFR 264.253 TO STORE THE MATERIAL AS IF RCRA WERE APPLICABLE. THE FACILITY WILL INCLUDE A LINER, A LEACHATE COLLECTION



AND REMOVAL SYSTEM, A RUN-ON CONTROL SYSTEM, A RUNOFF MANAGEMENT SYSTEM AND A COVER FOR AREAS WHICH CONTAIN PARTICULATE MATTER SUBJECT TO WIND DISPERSAL.

THE COLLECTION AND HOLDING FACILITIES WITHIN THE TEMPORARY STORAGE AREA WERE EVALUATED WITH RESPECT TO RCRA REQUIREMENTS IN SUBPART K, SECTION 264.223 AND THE MISSOURI HAZARDOUS WASTE MANAGEMENT LAWS FOR SURFACE IMPOUNDMENTS. THE STATE AND FEDERAL RCRA REQUIREMENTS FOR SURFACE IMPOUNDMENTS ARE NOT LEGALLY APPLICABLE BUT MAY BE RELEVANT AND APPROPRIATE. THE DESIGN REQUIREMENTS FOR A DOUBLE LINER SYSTEM SPECIFIED IN 40 CFR 264.221(C) ARE RELEVANT AND APPROPRIATE. HOWEVER, CONSIDERING THE EXPECTED DURATION OF STORAGE, THE CLAY LINER REQUIREMENT OF 10 CSR 25-7.264(2)(K) IS NOT APPROPRIATE. THE SOIL UNDERLYING THE PROPOSED LOCATION FOR THE TEMPORARY STORAGE AREA IS ALREADY CONTAMINATED; THE EVENTUAL REMEDY OF THE CHEMICAL PLANT AREA WILL INCLUDE REMEDIATION OF ON-SITE CONTAMINATED SOIL.

SIMILARLY, THE GROUNDWATER PROTECTION REQUIREMENTS OF 40 CFR 264 SUBPART F ARE NOT LEGALLY APPLICABLE BUT THE GROUNDWATER MONITORING REQUIREMENTS ARE CONSIDERED TO BE RELEVANT AND APPROPRIATE. THE GROUNDWATER RESPONSE REQUIREMENTS, HOWEVER, ARE NOT CONSIDERED TO BE RELEVANT AND APPROPRIATE TO THIS REMEDIAL ACTION, WHICH DOES NOT ADDRESS GROUNDWATER REMEDIATION. EVEN IF THE GROUNDWATER RESPONSE REQUIREMENTS WERE FOUND TO BE RELEVANT AND APPROPRIATE, THEY COULD BE WAIVED PURSUANT TO SECTION 121(D)(4)(A) AND SECTION 121(D)(4)(C) OF CERCLA. WHILE NOT A PART OF THIS REMEDIAL ACTION, GROUNDWATER REMEDIATION WILL BE ADDRESSED IN THE FINAL REMEDIATION OF THE CHEMICAL PLANT AREA. IN ADDITION, IT IS NOT PRACTICAL TO SEPARATE GROUNDWATER UNDER THE TEMPORARY STORAGE AREA FROM GROUNDWATER BEING ADDRESSED AS PART OF THE OVERALL RI/PS-EIS CURRENTLY BEING PREPARED FOR REMEDIATION OF THE ENTIRE CHEMICAL PLANT AREA.

SIMILARLY, THE REQUIREMENTS OF 40 CFR 264.258, CLOSURE AND POST-CLOSURE CARE, ARE NOT LEGALLY APPLICABLE AND ARE NOT CONSIDERED TO BE RELEVANT AND APPROPRIATE TO THE QUARRY BULK WASTE REMEDIAL ACTION. IF FOUND TO BE RELEVANT AND APPROPRIATE, THESE REQUIREMENTS COULD BE WAIVED UNDER SECTION 121(D)(4)(A) AND SECTION 121(D)(4)(C) OF CERCLA. THE CLOSURE REQUIREMENTS ARE NOT PERTINENT SINCE THE BULK WASTE REMOVAL AND STORAGE IS AN INTERIM ACTION AND CLOSURE OF THE TEMPORARY STORAGE AREA CANNOT ADEQUATELY BE ADDRESSED UNTIL THE FINAL REMEDY FOR THE CHEMICAL PLANT AREA IS SELECTED. IN ADDITION, IT IS TECHNICALLY IMPRACTICAL TO CLOSE

THE TEMPORARY STORAGE AREA UNTIL THE MATERIAL CAN BE REMOVED FOR FINAL DISPOSITION CONSISTENT WITH THE ULTIMATE SITE REMEDY. THE TEMPORARY STORAGE AREA WILL NOT BE CLOSED WITH THE WASTES IN PLACE.

OTHER CONSIDERATIONS FOR STORAGE INCLUDE PORTIONS OF THE LAND DISPOSAL RESTRICTIONS, 40 CFR 264 SUBPART E AND THE TOXIC SUBSTANCES CONTROL ACT, 40 CFR 761.65. THESE REQUIREMENTS DEAL WITH PROHIBITIONS ON STORAGE AND MAY BE APPLICABLE FOR THIS ACTION. THE LIMITATIONS ON STORAGE TIME ARE WAIVED UNDER THE PROVISIONS OF SECTION 121(D)(4)(A) AND SECTION 121(D)(4)(C) OF CERCLA SINCE THE SCHEDULE FOR FINAL DISPOSITION OF THE



QUARRY BULK WASTES IS CONTROLLED BY THE DECISION MAKING PROCESS FOR REMEDIATION OF THE CHEMICAL PLANT AREA. IT IS NOT TECHNICALLY FEASIBLE TO COMPLY WITH THE TIME LIMITATIONS SINCE A REMEDY FOR THE CHEMICAL PLANT AREA WILL NOT BE SELECTED IN THE REQUIRED TIME FRAME.

AN ADDITIONAL ACTION-SPECIFIC CONSIDERATION IS FOR TRANSPORTATION. REQUIREMENTS PERTAINING TO TRANSPORTATION OF RADIOACTIVE AND CHEMICALLY HAZARDOUS WASTES ARE NOT LEGALLY APPLICABLE TO THIS ACTION, BUT SOME PORTIONS ARE RELEVANT AND APPROPRIATE. FOR PURPOSES OF THIS ACTION, A SIMPLIFIED MANIFEST SYSTEM WILL BE DEVELOPED. THIS SYSTEM WILL INCLUDE TRACKING WASTE SHIPMENTS FROM THE QUARRY TO THE TEMPORARY STORAGE AREA; PLACARDING THE TRUCKS; AND USING STRONG, TIGHT CONTAINERS TO PREVENT LEAKAGE UNDER CONDITIONS NORMALLY INCIDENT TO TRANSPORTATION.

CONTAMINANT-SPECIFIC ARARS

THE ANALYSIS OF CONTAMINANT-SPECIFIC ARARS WAS PERFORMED TO ADDRESS EACH MAJOR ENVIRONMENTAL LAW OR REGULATION PERTINENT TO THE TYPES OF CONTAMINANTS THAT WILL BE ENCOUNTERED DURING THIS REMEDIAL ACTION.

NESHAP REQUIREMENTS FOR RADIONUCLIDES, GIVEN IN 40 CFR 61 SUBPARTS H AND Q, AND ASBESTOS GIVEN IN SUBPART M ARE LEGALLY APPLICABLE TO ALL PHASES OF THE ACTION.

STATE STANDARDS FOUND IN 10 CSR 10-5.100 PERTAINING TO CONTROL OF AIRBORNE PARTICULATE MATTER, AND IN 10 CSR 10-5.180 PERTAINING TO PARTICULATE STANDARDS FOR INTERNAL COMBUSTION ENGINES ARE APPLICABLE TO THE IMPLEMENTATION PHASE AND WILL BE MET.

40 CFR 192.02(B) (1) ADDRESSES RELEASES OF RADON FROM URANIUM MILL TAILINGS DISPOSAL PILES. THESE STANDARDS WILL BE RELEVANT AND APPROPRIATE AFTER THE BULK WASTES HAVE BEEN PLACED IN CONTROLLED STORAGE. AT THAT TIME, THE TEMPORARY STORAGE AREA WILL MEET THE RADON-222 FLUX STANDARDS SPECIFIED IN 40 CFR 192.02(B) (1). THESE STANDARDS REQUIRE REASONABLE ASSURANCE THAT RADON-222 RELEASES WILL NOT (1) EXCEED AN AVERAGE RELEASE RATE OF 20 PCI/M2/SEC OR (2) INCREASE THE ANNUAL AVERAGE CONCENTRATION OF RADON-222 IN AIR AT OR ABOVE ANY LOCATION OUTSIDE THE SITE PERIMETER BY MORE THAN 0.5 PCI/L.

ALTHOUGH DOE ORDERS ARE NOT ARARS IN THAT THEY ARE NOT PROMULGATED

STANDARDS, THE RADIATION PROTECTION REQUIREMENTS GIVEN IN DOE ORDERS 5400.5 AND 5480.11 ARE MOST SUITABLE FOR THIS ACTION. THE REQUIREMENTS IN THESE TWO ORDERS ARE BASED ON RECENT RADIATION DOSIMETRY MODELS WHILE THE RADIATION PROTECTION REQUIREMENTS IN BOTH 10 CFR 20 AND 19 CSR 20 ARE BASED ON OUT-OF-DATE DOSIMETRY CONSIDERATIONS. HENCE, THE ACTION WILL BE CONDUCTED IN ACCORDANCE WITH THESE TWO DOE ORDERS FOR RADIATION PROTECTION. AS DISCUSSED IN SECTION 7.1.6, THE REQUIREMENTS IN 10 CFR 20 ARE CURRENTLY BEING REVISED. THE ACTION WILL COMPLY WITH ANY PROVISIONS IN THE REVISED 10 CFR 20 AND SUBSEQUENT REVISIONS TO 19 CSR 20 THAT ARE MORE STRINGENT THAN THOSE IN THESE TWO DOE ORDERS.



THE STATE RADON-222 LIMIT OF 1 PC/L IN UNCONTROLLED AREAS CANNOT BE ACHIEVED DURING IMPLEMENTATION OF THIS ACTION. THIS STANDARD IS WAIVED PURSUANT TO SECTION 121(D)(4)(C) OF CERCLA DURING IMPLEMENTATION. THIS REQUIREMENT WILL BE ACHIEVED UPON COMPLETION OF THE ACTION.

STANDARDS OF CONTROL ARE ESTABLISHED UNDER THE TOXIC SUBSTANCES CONTROL ACT FOR THE CLEANUP OF PCB SPILLS AND FOR ASBESTOS EXPOSURE LIMITS. 40 CPR 761.125 ADDRESSES CLEANUP REQUIREMENTS FOR PCB SPILLS AND IS APPLICABLE DURING TRANSPORT OF THE BULK WASTES. PERMISSIBLE EXPOSURE LIMITS TO ASBESTOS FIBERS ARE ADDRESSED IN 40 CFR 763.121(C). THE STANDARD IS RELEVANT AND APPROPRIATE TO THE IMPLEMENTATION PHASE OF THIS ACTION.

COST EFFECTIVENESS

THE SELECTED REMEDY IS ESTIMATED TO COST ABOUT $11 MILLION AND IS EXPECTED TO BE IMPLEMENTED IN 15 MONTHS. THESE FIGURES, HOWEVER, ARE BASED ON CONCEPTUAL ESTIMATES PERFORMED EARLY IN THE RI/FS PROCESS AND BOTH ARE LIKELY TO INCREASE AS ENGINEERING DESIGN IS COMPLETED. THIS REMEDY IS COST EFFECTIVE SINCE POSTPONING THE ACTION COULD RESULT IN THE CONTINUED SPREAD OF CONTAMINATION IN THE QUARRY AREA. THIS WOULD RESULT IN THE NEED FOR A MORE EXTENSIVE CLEANUP EFFORT IN THE FUTURE. IN ADDITION, DELAYING ACTION WOULD RESULT IN HIGHER COSTS DUE TO INFLATION. BOTH OF THESE EFFECTS WILL BE MINIMIZED BY IMPLEMENTING THE SELECTED REMEDY. IN ADDITION, THIS REMEDY WOULD PROMOTE THE EFFECTIVENESS OF REMEDIATION OF THE ENTIRE WELDON SPRING SITE BY FACILITATING DETAILED CHARACTERIZATION OF (1) THE QUARRY SUBSURFACE TO ADDRESS FOLLOW-ON REMEDIATION, AND (2) THE BULK WASTES TO SUPPORT COMPREHENSIVE WASTE MANAGEMENT DECISIONS FOR THE ENTIRE WELDON SPRING SITE.

UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

THE SELECTED REMEDY WILL RESULT IN THE PERMANENT REMOVAL OF THE BULK WASTES FROM THE QUARRY. THIS WILL REMOVE THE SOURCE OF CONTAMINANT RELEASES TO THE AIR AND GROUNDWATER IN THE QUARRY AREA. THE USE OF ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES IS BEYOND THE SCOPE OF THE QUARRY BULK WASTE REMEDIAL ACTION. THIS ACTION WILL NOT RESULT IN A PERMANENT SOLUTION FOR EITHER THE QUARRY OR THE

BULK WASTES. A FINAL DECISION FOR THE QUARRY AREA WILL BE MADE FOLLOWING REMOVAL OF THE BULK WASTES (THIS ACTION) AND COMPLETION OF DETAILED STUDIES ON THE NEED TO PERFORM ADDITIONAL REMEDIATION IN THE QUARRY AREA. TREATMENT AND DISPOSAL DECISIONS FOR THE WASTES WILL BE INCLUDED IN THE RI/FS-EIS FOR REMEDIATION OF THE CHEMICAL PLANT AREA.

PREFERENCE FOR TREATMENT PRINCIPAL

TREATMENT OF THE BULK WASTES TO REDUCE TOXICITY, MOBILITY, AND VOLUME IS BEYOND THE SCOPE OF THIS ACTION. THE ACTION IS LIMITED TO EXCAVATION OF



THE BULK WASTES FROM THE QUARRY WITH TRANSPORT TO, AND TEMPORARY STORAGE AT, THE CHEMICAL PLANT AREA. THE WASTES WILL BE TREATED ONLY TO FACILITATE TRANSPORTATION AND STORAGE ACTIVITIES (E. G., SEGREGATION, DEWATERING). THEY WILL BE CHARACTERIZED IN DETAIL AFTER THEY ARE PLACED IN CONTROLLED STORAGE IN THE CHEMICAL PLANT AREA. THE RESULTS OF THIS DETAILED CHARACTERIZATION WILL BE USED TO FINALIZE DECISIONS ON POTENTIAL TREATMENT STRATEGIES TO REDUCE TOXICITY, MOBILITY, AND VOLUME.

#RS
RESPONSIVENESS SUMMARY

THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) DOCUMENTS WERE ISSUED TO THE GENERAL PUBLIC ON MARCH 5, 1990, AND THE PUBLIC COMMENT PERIOD EXTENDED THROUGH APRIL 9, 1990. A PUBLIC MEETING WAS HELD ON MARCH 29, 1990, AT THE RAMADA INN IN WENTZVILLE, MISSOURI, AS A PART OF THE COMMUNITY PARTICIPATION PROCESS. IN ADDITION TO THE PUBLIC MEETING, THE US DEPARTMENT OF ENERGY (DOE) HELD NUMEROUS BRIEFINGS AND MEETINGS WITH PUBLIC OFFICIALS, SCHOOL ADMINISTRATORS, SPECIAL INTEREST GROUPS, AND MEMBERS OF THE GENERAL PUBLIC. A SEPARATE RESPONSIVENESS SUMMARY DOCUMENT HAS BEEN PREPARED TO ADDRESS THE ISSUES RAISED DURING THE PUBLIC COMMENT PERIOD. THIS DOCUMENT LISTS THE MAJOR ISSUES RAISED IN ORAL AND WRITTEN COMMENTS ON THE RI/FS DOCUMENTS AND PROVIDES THE DOE RESPONSES TO THESE ISSUES. IN ADDITION, INDIVIDUAL RESPONSES TO ALL WRITTEN COMMENTS ARE PROVIDED. THE FOLLOWING DISCUSSION, WHICH HAS BEEN EXTRACTED FROM THE RESPONSIVENESS SUMMARY DOCUMENT, PROVIDES SUMMARIES OF THE MAJOR ISSUES ASSOCIATED WITH THE PROPOSED ACTION FOLLOWED BY DOE RESPONSES.

THE CONCEPTUAL APPROACH FOR IMPLEMENTING THE PREFERRED ALTERNATIVE, AS PRESENTED IN CHAPTER 8 OF THE FS REPORT, WAS REVISED FOLLOWING RECEIPT OF THE PUBLIC COMMENTS. THE APPROACH CURRENTLY BEING EVALUATED IS TO CONDUCT BASIC WASTE SORTING AT THE QUARRY, LOAD THE SORTED WASTES INTO CONTAINERS SUCH AS LARGE STEEL BOXES, AND TRANSFER THE CONTAINERS TO TRUCKS FOR TRANSPORT TO THE CHEMICAL PLANT AREA. AT THE CHEMICAL PLANT AREA, THE CONTAINERS WILL BE UNLOADED AND THE WASTES PLACED DIRECTLY INTO CONTROLLED STORAGE. THE EMPTY CONTAINERS WILL BE RETURNED TO THE QUARRY FOR REUSE. SUCH AN APPROACH COULD ALLOW FOR THE RETURN TRIP TO BE ON THE DEDICATED HAUL ROAD ELIMINATING ALL TRUCK TRAFFIC ON STATE ROUTE 94. THIS APPROACH WILL BE EVALUATED IN DETAIL AFTER THIS RECORD

OF DECISION IS ISSUED.

ISSUE 1

COMMENT: THE RI/FS DOCUMENTS INCLUDE A DISCLAIMER IN WHICH IT IS STATED THAT THE DOE DOES NOT ASSUME ANY LEGAL LIABILITY OR RESPONSIBILITY FOR THE ACCURACY, COMPLETENESS, OR USEFULNESS OF THE INFORMATION INCLUDED IN THE DOCUMENTS. HOW CAN THE DOE PROCEED WITH THIS ACTION WHEN IT DOES NOT STAND BEHIND THE INFORMATION SUPPORTING ITS SELECTION?



RESPONSE: THE DISCLAIMER WAS INCLUDED IN THESE DOCUMENTS BY MISTAKE. THE DOE DOES INDEED STAND BEHIND THE INFORMATION AND ANALYSES PROVIDED IN THE RI, BASELINE RISK EVALUATION (BRE), AND FS. THIS DISCLAIMER IS USED IN DOCUMENTS SUMMARIZING WORK SPONSORED BY THE DOE THAT IS EXPERIMENTAL OR DEVELOPMENTAL IN NATURE. ITS PURPOSE IS TO EXEMPT THE DOE AND ITS CONTRACTORS FROM LEGAL LIABILITY FOR RESEARCH ACTIVITIES SO THAT NEW IDEAS AND CONCEPTS CAN BE EXPLORED WITHOUT BEING RESTRICTED BY LEGAL CONSTRAINTS. THESE CONDITIONS DO NOT APPLY TO THIS RI/FS.

ISSUE 2

COMMENT: THE PROPOSED ACTION ENTAILS TEMPORARY STORAGE OF THE BULK WASTES AT THE CHEMICAL PLANT AREA. HOW LONG IS "TEMPORARY" STORAGE?

RESPONSE: THE QUARRY BULK WASTES ARE SCHEDULED TO BE IN TEMPORARY STORAGE FOR THREE TO SIX YEARS.

ISSUE 3

COMMENT: HOW DO WE KNOW THAT TEMPORARY STORAGE WILL NOT BECOME PERMANENT?

RESPONSE: THE TEMPORARY STORAGE FACILITY WILL NOT BE DESIGNED TO MEET PERMANENT DISPOSAL REQUIREMENTS NOR IS THERE ANY CONSIDERATION OF EVER UPGRADING IT TO MEET SUCH REQUIREMENTS. PERMANENT DISPOSAL REQUIRES SEPARATE PROCESSES OF ENVIRONMENTAL COMPLIANCE, REGULATORY CONCURRENCE, AND PUBLIC INVOLVEMENT. THIS DOES NOT MEAN THAT CONSTRUCTION OF A PERMANENT DISPOSAL CELL ON SITE WILL NOT BE CONSIDERED IN THE FUTURE; HOWEVER, IT DOES MEAN THAT TEMPORARY STORAGE OF THE BULK WASTES WILL NOT INFLUENCE THAT DISPOSAL DECISION.

ISSUE 4

COMMENT: REMOVAL OF THE QUARRY BULK WASTES WITH TEMPORARY STORAGE IN THE CHEMICAL PLANT AREA IS ONLY AN INTERIM ACTION IN THE OVERALL REMEDIATION OF THE WELDON SPRING SITE. WHEN WILL A DECISION ON THE PERMANENT DISPOSAL OF ALL SITE WASTES BE REACHED?

RESPONSE: THE DOE IS CURRENTLY PREPARING AN RI/FS UNDER THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

(CERCLA) TO EVALUATE ALTERNATIVES FOR THE PERMANENT DISPOSAL OF ALL WASTES GENERATED BY REMEDIATING THE WELDON SPRING SITE. THE ANALYSES IN THAT RI/FS WILL INCLUDE THOSE REQUIRED IN AN ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR COMPLIANCE WITH THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA). THIS INTEGRATED CERCLA/NEPA APPROACH IS BEING REFERRED TO AS THE RI/FS-EIS PROCESS. THE RI/FS-EIS IS BEING PREPARED CONSISTENT WITH US ENVIRONMENTAL PROTECTION AGENCY (EPA) GUIDANCE; A PRELIMINARY INTERNAL REVIEW DRAFT WILL BE AVAILABLE IN LATE 1990. THE RI/FS-EIS DOCUMENTS WILL BE AVAILABLE FOR REVIEW BY EPA REGION VII, THE STATE OF MISSOURI, AND THE GENERAL PUBLIC IN 1991, AND A JOINT EPA/DOE RECORD OF



DECISION FOR THIS PROPOSED ACTION WILL BE ISSUED IN 1992.

ISSUE 5

COMMENT: THE QUARRY BULK WASTES SHOULD NOT BE MOVED UNTIL A PERMANENT DISPOSAL DECISION HAS BEEN REACHED FOR MANAGING ALL WASTES FROM THE WELDON SPRING SITE AND A DISPOSAL FACILITY IS READY TO ACCEPT THE WASTES. THIS INTERIM REMEDIAL ACTION IS NOT A WISE EXPENDITURE OF TAX DOLLARS.

RESPONSE: DELAYING THIS INTERIM REMEDIAL ACTION WOULD POSTPONE THE ATTAINMENT OF REMEDIAL ACTION OBJECTIVES AT THE QUARRY (E.G., TO RESPOND TO ONGOING RELEASES BY REMOVING THE PRIMARY SOURCE OF CONTAMINATION FROM THE QUARRY AND TO INITIATE NECESSARY CHARACTERIZATION ACTIVITIES). THE PREFERRED ALTERNATIVE CAN BE IMPLEMENTED IN A MANNER THAT WILL NOT ENDANGER STUDENTS AND STAFF AT FRANCIS HOWELL HIGH SCHOOL OR ANY OTHER INDIVIDUALS IN THE AREA. THE EXTENSIVE MONITORING PROGRAM CURRENTLY IN PLACE WILL BE EXPANDED PRIOR TO INITIATING THE PROPOSED ACTION TO ENSURE THE HEALTH AND SAFETY OF NEARBY RESIDENTS AND THE ENVIRONMENT.

THE DOE IS CURRENTLY PREPARING AN RI/FS-EIS TO EVALUATE ALTERNATIVES FOR THE PERMANENT DISPOSAL OF ALL WASTES GENERATED BY REMEDIATING THE WELDON SPRING SITE. ALTHOUGH THE RI/FS-EIS WILL BE AVAILABLE FOR PUBLIC REVIEW AND COMMENT IN 1991, THE LENGTH OF TIME TO IMPLEMENT PERMANENT DISPOSAL OPTIONS WILL TAKE SEVERAL MORE YEARS. DELAYING THE PROPOSED REMOVAL OF THE BULK WASTES WOULD RESULT IN CONTINUED UNCONTROLLED RELEASE OF CONTAMINANTS TO THE ENVIRONMENT IN THE QUARRY AREA. THE PROPOSED ACTION IS BEING TAKEN AT THIS TIME TO RESPOND TO THIS RELEASE.

ALTHOUGH SOME ADDITIONAL COST WILL BE INCURRED BY PLACING THE BULK WASTES IN TEMPORARY STORAGE, MOST OF THE COMPONENTS ASSOCIATED WITH THIS ACTION WILL BE REQUIRED WHETHER THE ACTION IS TAKEN NOW OR IN THE FUTURE. THE WASTES MUST BE REMOVED AND CHARACTERIZED TO PERMIT AN INFORMED EVALUATION OF VARIOUS TREATMENT OPTIONS PRIOR TO FINAL DISPOSAL. HENCE, THE INCREMENTAL COST IS A GOOD EXPENDITURE OF FUNDS BASED ON THE CONSIDERABLE BENEFITS ASSOCIATED WITH EXPEDITING THE ACTION, I.E., THE PROPOSED ACTION WILL PROTECT HUMAN HEALTH AND THE ENVIRONMENT AND SUPPORT OVERALL WASTE MANAGEMENT DECISIONS FOR THE PROJECT. THESE AND OTHER REASONS FOR CONDUCTING THE PROPOSED ACTION ARE DISCUSSED IN GREATER DETAIL IN THE FS.

ISSUE 6

COMMENT: WHY NOT SIMPLY MOVE THE WELL FIELD TO ENSURE THE SAFETY OF THIS SOURCE OF POTABLE WATER? THIS WOULD BE A MUCH SIMPLER AND CHEAPER SOLUTION.

RESPONSE: THERE IS CURRENTLY NO NEED TO CONSIDER MOVING THE WELL FIELD OR PROVIDING AN ALTERNATIVE SOURCE OF POTABLE WATER BECAUSE THE WATER IN THIS WELL FIELD IS NOT CONTAMINATED. REMOVING THE SOURCE OF POTENTIAL



THREAT TO THE WELL FIELD IS ONLY ONE OF THE REASONS FOR THIS ACTION. THE BULK WASTES MUST BE REMOVED IN ORDER TO PERFORM DETAILED CHARACTERIZATION OF THE WASTES FOR EVALUATING APPROPRIATE TREATMENT TECHNOLOGIES AND DISPOSAL ALTERNATIVES. IN ADDITION, THE WASTES MUST BE REMOVED TO ALLOW FOR DETAILED CHARACTERIZATION OF THE QUARRY AREA. REMOVAL OF THE BULK WASTES IS RESPONSIVE TO THE NEED TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT AND ALSO SERVES TO PROTECT AN IMPORTANT NATURAL RESOURCE (I.E., THE GROUNDWATER IN THIS AREA).

ISSUE 7

COMMENT: WILL ANY WASTES FROM OTHER AREAS BE BROUGHT TO THE WELDON SPRING SITE FOR DISPOSAL?

RESPONSE: THE PROPOSED ACTION IS LIMITED TO MANAGEMENT OF THE QUARRY BULK WASTES. MANAGEMENT OF ALL WASTES FROM CLEANUP OF THE WELDON SPRING SITE IS THE SUBJECT OF A SEPARATE RI/FS-EIS PROCESS THAT IS CURRENTLY UNDER DEVELOPMENT. THERE ARE NO PLANS TO BRING WASTES FROM OTHER AREAS TO THE WELDON SPRING SITE FOR DISPOSAL. THE RECORD OF DECISION FOR REMEDIATION OF THE CHEMICAL PLANT AREA OF THE WELDON SPRING SITE WILL ADDRESS THE SCOPE OF WASTE DISPOSAL AND LIMITATIONS ON USE OF THE WELDON SPRING SITE FOR FUTURE ACTIONS.

ISSUE 8

COMMENT: THE WASTES SHOULD BE SORTED AND CONTAINERIZED AT THE QUARRY PRIOR TO TRANSPORT TO THE CHEMICAL PLANT AREA FOR TEMPORARY STORAGE.

RESPONSE: THIS TYPE OF ISSUE WOULD TYPICALLY BE ADDRESSED DURING THE ENGINEERING DESIGN PHASE OF THE PROJECT. HOWEVER, THE DOE HAS REVIEWED THIS CONCEPT AND BELIEVES IT HAS MERIT. THE APPROACH CURRENTLY BEING EVALUATED IS TO CONDUCT BASIC SORTING AT THE QUARRY, LOAD THE SORTED WASTES INTO CONTAINERS SUCH AS LARGE STEEL BOXES, AND TRANSFER THE CONTAINERS TO TRUCKS FOR TRANSPORT TO THE CHEMICAL PLANT AREA. AT THE CHEMICAL PLANT AREA, THE CONTAINERS WILL BE UNLOADED AND THE WASTES PLACED DIRECTLY INTO CONTROLLED STORAGE; THE EMPTY CONTAINERS WILL BE RETURNED TO THE QUARRY FOR REUSE.

THIS APPROACH WOULD TEND TO DECOUPLE THE EXCAVATION, TRANSPORTATION, AND UNLOADING ACTIVITIES. FOR EXAMPLE, EXTRA CONTAINERS COULD BE LOADED AT

THE QUARRY DURING A SECOND SHIFT OR WHILE WASTES WERE BEING TRANSPORTED TO THE TEMPORARY STORAGE AREA. TRUCKS COULD TRAVEL ALONG THE HAUL ROAD IN SMALL CONVOYS (I.E., THREE TO SIX TRUCKS) TO THE TEMPORARY STORAGE AREA WHERE THE CONTAINERS WOULD BE OFF-LOADED. THE WASTES WOULD BE REMOVED FROM THE CONTAINERS AND PLACED INTO CONTROLLED STORAGE. EMPTY CONTAINERS WOULD BE LOADED ONTO THE TRUCKS AND RETURNED TO THE QUARRY. SUCH AN APPROACH COULD ALLOW FOR THE RETURN TRIP TO BE ON THE DEDICATED HAUL ROAD. PLANS FOR THE HAUL ROAD MAY NEED TO BE MODIFIED TO INCLUDE SEVERAL TURNOUTS WHICH, IN CONJUNCTION WITH RADIO CONTACT, WOULD ALLOW SAFE PASSAGE OF TRUCK TRAFFIC. THIS WOULD ELIMINATE ALL TRUCK TRAFFIC



ON ROUTE 94.

ISSUE 9

COMMENT: WHY IS IT NECESSARY TO MOVE THE WASTES CLOSER TO FRANCIS HOWELL HIGH SCHOOL FOR TEMPORARY STORAGE? WHY NOT TAKE THE QUARRY WASTES SOMEWHERE ELSE FOR DISPOSAL?

RESPONSE: NO DISPOSAL FACILITY IS CURRENTLY AVAILABLE FOR THE QUARRY WASTES. FURTHERMORE, A PERMANENT WASTE DISPOSAL DECISION IS A VERY COMPLEX ISSUE AND WILL NOT BE MADE FOR A FEW YEARS. THEREFORE, THE ONLY ALTERNATIVES AT THIS TIME ARE EITHER TO REMOVE THE QUARRY BULK WASTES AND TEMPORARILY STORE THEM PENDING A WASTE DISPOSAL DECISION OR DELAY THE QUARRY CLEANUP ACTION. THE DOE BELIEVES IT IS IMPORTANT TO INITIATE THE QUARRY CLEANUP ACTION AS SOON AS POSSIBLE (SEE RESPONSES TO ISSUES 5 AND 6). THE QUESTION THEN BECOMES WHERE TO STORE THESE WASTES.

IN ADDITION TO THE FACT THAT THERE IS SIMPLY NO OTHER AVAILABLE SPACE, THERE ARE SEVERAL GOOD REASONS FOR TEMPORARILY STORING THE WASTES IN THE CHEMICAL PLANT AREA. ON-SITE STORAGE WILL ENSURE THAT NO INDIVIDUALS ARE INADVERTENTLY EXPOSED BECAUSE ACCESS TO THE CHEMICAL PLANT AREA IS CONTROLLED. ALSO, THE PRESENCE OF ON-SITE DOE AND CONTRACTOR STAFF WILL ENSURE CONTINUOUS OVERSIGHT. THE WASTES CAN BE SAFELY AND EXPEDITIOUSLY CHARACTERIZED TO ALLOW FOR AN INFORMED DECISION ON THEIR FINAL DISPOSAL TO BE MADE AS SOON AS POSSIBLE. FINALLY, THE EXTENSIVE MONITORING CAPABILITY AVAILABLE IN THE CHEMICAL PLANT AREA CAN BE USED TO ENSURE THE HEALTH AND SAFETY OF NEARBY RESIDENTS. THIS IS THE BEST WAY TO STORE THESE MATERIALS IN THE NEAR TERM.

ISSUE 10

COMMENT: THERE IS INSUFFICIENT ENGINEERING INFORMATION ON THE PROPOSED ACTION TO ADEQUATELY ASSESS THE FEASIBILITY OF ITS IMPLEMENTATION. IT IS NOT POSSIBLE TO SELECT AN ALTERNATIVE WITH THE LEVEL OF DETAIL PROVIDED IN THE RI/FS DOCUMENTS.

RESPONSE: THE LEVEL OF DETAIL PROVIDED IN THE RI/FS DOCUMENTS IS CONSISTENT WITH THAT REQUIRED BY THE EPA FOR ACTIONS OF THIS MAGNITUDE. DETAILED ENGINEERING FOR THIS ACTION CANNOT BE INITIATED UNTIL THE RECORD OF DECISION HAS BEEN ISSUED. HOWEVER, THE ANALYSES PRESENTED IN

THE RI/FS AND SUPPORTING DOCUMENTS DEMONSTRATE THAT THIS ACTION CAN BE PERFORMED SAFELY AND IN COMPLIANCE WITH ALL APPLICABLE STANDARDS AND REGULATIONS. THIS INFORMATION IS SUFFICIENT TO ALLOW FOR SELECTION OF AN ALTERNATIVE.

THE LEVEL OF DETAIL NECESSARY TO DETERMINE THE ENGINEERING FEASIBILITY OF THIS ACTION IS PRESENTED IN THE PRELIMINARY ENGINEERING REPORT SUPPORTING THE FS. THE DESIGN DOCUMENTS TO BE DEVELOPED FOLLOWING ISSUANCE OF THE RECORD OF DECISION WILL FOCUS ON THE PHYSICAL ASPECTS OF THIS ACTION SUCH AS EQUIPMENT NEEDS, OPERATIONAL REQUIREMENTS, MATERIAL



HANDLING, AND COST. PLANNING RELATED TO DEALING SAFELY WITH THE VARIOUS TYPES OF CONTAMINANTS AND HAZARDS THAT MAY BE ENCOUNTERED WILL BE PRESENTED IN AN OPERATIONAL ENVIRONMENTAL, SAFETY, AND HEALTH PLAN. THE RESULTS OF THESE TWO PLANNING EFFORTS WILL ENSURE THAT THIS ACTION IS IMPLEMENTED SAFELY.

ISSUE 11

COMMENT: THERE IS INSUFFICIENT CHARACTERIZATION DATA TO ADEQUATELY PLAN THIS ACTION.

RESPONSE: PREVIOUS INVESTIGATIONS HAVE PROVIDED A SIGNIFICANT AMOUNT OF INFORMATION ON THE PHYSICAL, CHEMICAL, AND RADIOLOGICAL CHARACTERISTICS OF THE WASTES. THE RESULTS OF THESE INVESTIGATIONS, WHICH ARE PRESENTED IN THE RI, ARE CONSISTENT WITH THE DISPOSAL HISTORY AT THE QUARRY. THIS INFORMATION IS SUFFICIENT TO DESIGN A SAFE PLAN FOR THE REMOVAL, TRANSPORT, AND TEMPORARY STORAGE OF THE BULK WASTES.

IT IS POSSIBLE THAT SOME UNKNOWN WASTE MATERIAL WAS PLACED IN THE QUARRY. IN DESIGNING THE WASTE REMOVAL PROCESS, AN OBSERVATIONAL APPROACH WILL BE USED TO DEAL WITH THIS POSSIBILITY. IN THIS APPROACH, PLANNING IS BASED ON AVAILABLE DATA AND REALISTIC ASSUMPTIONS CONCERNING FIELD CONDITIONS. ADJUSTMENTS ARE MADE IN THE FIELD AS WORK PROCEEDS. DEVIATIONS FROM EXPECTED CONDITIONS AND MECHANISMS BY WHICH TO IDENTIFY THEIR OCCURRENCE ARE DEFINED, AND PLANS ARE DEVELOPED TO ADDRESS OR MITIGATE ADVERSE EFFECTS THAT RESULT FROM THESE DEVIATIONS. THIS APPROACH ENSURES RESPONSIVENESS TO ACTUAL FIELD CONDITIONS.

ISSUE 12

COMMENT: THE QUARRY BULK WASTES CONTAIN RESIDUAL CONCENTRATIONS OF TRINITROTOLUENE (TNT), DINITROTOLUENE (DNT), AND THEIR DECOMPOSITION PRODUCTS. IS THERE ANY POSSIBILITY THAT AN EXPLOSION COULD OCCUR WHILE THE BULK WASTES ARE BEING REMOVED?

RESPONSE: THE HIGHEST MEASURED CONCENTRATION OF TNT IN THE BULK WASTES IS ABOUT 2 PERCENT. THIS VALUE IS THE RESULT OF BIASED SAMPLING IN WHICH AREAS OF SURFICIAL DISCOLORATION WERE TARGETED IN AN EFFORT TO DEFINE THE MAXIMUM CONCENTRATIONS. THE MEASURED VALUE OF 2 PERCENT IS WELL BELOW THE CONCENTRATION THAT PRESENTS AN EXPLOSIVE HAZARD DURING

EXCAVATION (WHICH IS 12 PERCENT TO 15 PERCENT). THE CONCENTRATIONS OF DNT AND DECOMPOSITION PRODUCTS OF TNT AND DNT IN THE BULK WASTES ARE MUCH LOWER THAN THE MEASURED CONCENTRATION OF TNT. THE PROPOSED ACTION HAS BEEN REVIEWED BY HERCULES, INC., A COMPANY WITH EXTENSIVE EXPERTISE IN DEALING WITH EXPLOSIVES. THEIR TECHNICAL REVIEW CONCLUDED THAT THE CURRENT PLAN IS FEASIBLE AND THAT AN EXPLOSION IS HIGHLY UNLIKELY. HOWEVER, THE CONCENTRATION OF NITROAROMATIC COMPOUNDS IN THE BULK WASTES WILL BE EVALUATED AS THE WASTES ARE BEING EXCAVATED TO ENSURE THAT THERE ARE NO POCKETS CONTAINING MUCH HIGHER CONCENTRATIONS OF TNT THAT COULD PRESENT AN EXPLOSIVE HAZARD. PLANS WILL BE IN PLACE TO DEAL WITH



EXPLOSIVE CONCENTRATIONS OF TNT IN THE UNLIKELY EVENT OF SUCH AN OCCURRENCE.

ISSUE 13

COMMENT: EFFECTIVE RADON AND DUST CONTROL MEASURES SHOULD BE USED TO MINIMIZE ATMOSPHERIC RELEASES WHILE IMPLEMENTING THIS ACTION.

RESPONSE: EXTENSIVE RADON AND DUST CONTROL MEASURES WILL BE IMPLEMENTED DURING ALL PHASES OF THIS ACTION THAT HAVE A POTENTIAL FOR CREATING AIRBORNE EMISSIONS. DURING EXCAVATION OF THE WASTES, EMISSIONS WILL BE CONTROLLED BY WATER SPRAYS, FOAMS, AND TARPAULINS, AS NEEDED. THE WASTES WILL BE TRANSPORTED TO THE CHEMICAL PLANT AREA IN TRUCKS ALONG A DEDICATED HAUL ROAD. CURRENT PLANS ARE TO PACKAGE THE WASTES IN CONTAINERS TO ENSURE MINIMAL RELEASES. DUST CONTROL MEASURES SIMILAR TO THOSE AT THE QUARRY WILL BE USED WHILE UNLOADING THE BULK WASTES AT THE TEMPORARY STORAGE AREA. FINALLY, ALL WASTES SUSCEPTIBLE TO WINDBLOWN EROSION OR RELEASE OF RADON GAS WILL BE COVERED AS SOON AS PRACTICAL FOLLOWING PLACEMENT IN THE TEMPORARY STORAGE AREA. THESE MEASURES WILL ENSURE MINIMAL RELEASES OF RADON GAS OR CONTAMINATED DUST AS A RESULT OF IMPLEMENTING THIS ACTION.

ISSUE 14

COMMENT: IT IS ESSENTIAL THAT REMEDIAL ACTIONS AT THE WELDON SPRING SITE BE IMPLEMENTED IN A MANNER THAT WILL NOT COMPROMISE THE HEALTH AND SAFETY OF THE PEOPLE OF ST. CHARLES COUNTY. A THOROUGH ENVIRONMENTAL MONITORING PROGRAM SHOULD BE PUT IN PLACE PRIOR TO INITIATING THIS ACTION TO ENSURE THE HEALTH AND SAFETY OF NEARBY RESIDENTS AND STUDENTS AND STAFF AT FRANCIS HOWELL HIGH SCHOOL.

RESPONSE. AN EXTENSIVE ENVIRONMENTAL MONITORING PROGRAM IS CURRENTLY IN PLACE AT BOTH THE QUARRY AND CHEMICAL PLANT AREAS. THIS PROGRAM PROVIDES EXTENSIVE INFORMATION ON THE CURRENT STATUS OF THESE TWO AREAS. THE MONITORING PROGRAM WILL BE EXPANDED AT BOTH AREAS BEFORE THE BULK WASTE REMEDIAL ACTION IS INITIATED. AN OPERATIONAL ENVIRONMENTAL, SAFETY, AND HEALTH PLAN IS CURRENTLY BEING PREPARED TO ADDRESS THE SPECIFIC NEEDS OF THIS ACTION. AN ARRAY OF AIR MONITORS WILL BE PLACED AT THE TEMPORARY STORAGE AREA AND SITE PERIMETER TO DETECT ANY AIRBORNE CONTAMINATION THAT COULD IMPACT FRANCIS HOWELL HIGH SCHOOL. THE HEALTH

AND SAFETY OF NEARBY INDIVIDUALS WILL NOT BE COMPROMISED BY THIS ACTION.

ISSUE 15

COMMENT: AN EMERGENCY RESPONSE PLAN SHOULD BE DEVELOPED BEFORE THIS ACTION IS INITIATED TO ADDRESS ACTIONS THAT WOULD BE TAKEN IF THERE ARE ANY SPILLS OR NATURAL DISASTERS. THIS PLAN SHOULD ADDRESS EARTHQUAKES, HIGH WINDS, TORNADOES, SPILLS, AND ANY OTHER EVENTS THAT COULD CAUSE LARGE RELEASES OF RADIOACTIVE AND CHEMICAL CONTAMINANTS TO THE ENVIRONMENT. THE FRANCIS HOWELL SCHOOL DISTRICT SHOULD BE PART OF THE



PLANNING PROCESS BECAUSE OF THE CLOSE PROXIMITY OF ITS ELEMENTARY AND HIGH SCHOOLS.

RESPONSE: THE DOE WILL DEVELOP AN EMERGENCY RESPONSE PLAN TO ADDRESS CREDIBLE EMERGENCY SITUATIONS CONSISTENT WITH THE HAZARDS POSED BY THE PROPOSED ACTION. THIS PLAN WILL IDENTIFY MEASURES TO BE TAKEN IN THE EVENT OF A SPILL, TRANSPORTATION ACCIDENT, OR NATURAL DISASTER. IN DEVELOPING THIS PLAN, THE DOE WILL INVOLVE THE FRANCIS HOWELL SCHOOL DISTRICT AND LOCAL OFFICIALS WHO WOULD REQUIRE NOTIFICATION OR COORDINATION IN THE EVENT OF AN EMERGENCY. REMOVAL OF THE BULK WASTES WILL NOT BEGIN UNTIL AN EMERGENCY RESPONSE PLAN IS IN PLACE.

ISSUE 16

COMMENT: THE ONGOING ENVIRONMENTAL MONITORING PROGRAM AT THE QUARRY NEEDS TO CONTINUE WITHOUT INTERRUPTION BEFORE, DURING, AND AFTER REMOVAL OF THE BULK WASTES. THIS IS THE ONLY WAY TO ENSURE THE SAFETY OF THE ST. CHARLES COUNTY WELL FIELD.

RESPONSE: THE ST. CHARLES COUNTY WELL FIELD IS BEING EXTENSIVELY MONITORED BY FEDERAL, STATE, AND LOCAL AUTHORITIES. THIS MONITORING INDICATES THAT THE WELL FIELD HAS NOT BEEN IMPACTED BY CONTAMINANTS MIGRATING FROM THE QUARRY. THE DOE WILL INCREASE ITS MONITORING EFFORTS DURING THE BULK WASTE REMEDIAL ACTION TO ENSURE THAT THIS ACTION DOES NOT RESULT IN CONTAMINATION IMPACTING THE WELL FIELD. MONITORING OF THE WELL FIELD WILL CONTINUE FOLLOWING REMOVAL OF THE BULK WASTES WHILE STUDIES ARE UNDERTAKEN TO EVALUATE THE NEED FOR ADDITIONAL REMEDIATION OF THIS AREA. MONITORING ACTIVITIES AT THE QUARRY WILL NOT BE DISCONTINUED UNTIL ALL FOLLOW-ON STUDIES HAVE BEEN COMPLETED AND ANY ADDITIONAL REMEDIAL ACTIONS HAVE BEEN IMPLEMENTED. SUCH FUTURE DECISIONS WILL RELY ON INPUT FROM EPA REGION VII, THE STATE OF MISSOURI, AND OFFICIALS FROM ST. CHARLES COUNTY.

ISSUE 17

COMMENT: SINCE THE LEVELS OF RADON ARE ELEVATED AT THE QUARRY, WHY MOVE THESE MATERIALS CLOSER TO FRANCIS HOWELL HIGH SCHOOL AND INCREASE THE RISK TO STUDENTS FROM RADIATION EXPOSURE?

RESPONSE: THE BULK WASTES ARE BEING REMOVED IN PART TO CONTROL RADON

EMISSIONS FROM THESE MATERIALS. THE RADIUM-CONTAMINATED SOILS WILL BE PLACED IN CONTROLLED STORAGE IN THE TEMPORARY STORAGE AREA AND COVERED WITH A LINER THAT IS VERY EFFECTIVE AT REDUCING RADON GAS RELEASES. MODELING STUDIES DESCRIBED IN THE FS INDICATE THAT THE RADON CONCENTRATIONS AT FRANCIS HOWELL HIGH SCHOOL RESULTING FROM THIS ACTION WOULD BE INDISTINGUISHABLE FROM BACKGROUND LEVELS. THE DOE WILL MONITOR FOR RADON-220, RADON-222, AND THEIR SHORT-LIVED DECAY PRODUCTS AT THE TEMPORARY STORAGE AREA, THE SITE PERIMETER, AND FRANCIS HOWELL HIGH SCHOOL DURING IMPLEMENTATION OF THE ACTION AND DURING THE TEMPORARY STORAGE PERIOD. THIS MONITORING PROGRAM WILL ALLOW FOR UPGRADING OF



RADON EMISSION CONTROLS, IF NECESSARY, TO PREVENT IMPACTS TO THE HIGH SCHOOL.

ISSUE 18

COMMENT: RESULTS OF ENVIRONMENTAL MONITORING ACTIVITIES NEED TO BE PROVIDED TO THE GENERAL PUBLIC IN A TIMELY MANNER. THE RESULTS OF 1988 ENVIRONMENTAL MONITORING ACTIVITIES WERE NOT ISSUED UNTIL JANUARY 1990. THE GENERAL PUBLIC NEEDS TO BE KEPT BETTER INFORMED, ESPECIALLY AS THE BULK WASTE REMEDIAL ACTION PROCEEDS.

RESPONSE: THE 1988 ENVIRONMENTAL MONITORING REPORT WAS ISSUED LATE DUE TO THE INTERNAL REVIEW PROCESS WITHIN THE DOE. THE 1989 ENVIRONMENTAL MONITORING REPORT WILL BE ISSUED IN THE NEAR FUTURE. THE DOE AGREES ON THE NEED TO PROVIDE ENVIRONMENTAL MONITORING RESULTS IN A TIMELY MANNER AND IS CURRENTLY DEVELOPING A PLAN TO ISSUE THE RESULTS OF ENVIRONMENTAL MONITORING ON A MORE FREQUENT BASIS. ANY ANOMALOUS ENVIRONMENTAL MONITORING DATA ASSOCIATED WITH THE BULK WASTE REMEDIAL ACTION WILL BE MADE AVAILABLE TO LOCAL AUTHORITIES AND ANY POTENTIALLY AFFECTED INDIVIDUALS AS SOON AS POSSIBLE.

ISSUE 19

COMMENT: THE REPORT RECENTLY RELEASED BY THE COMMITTEE ON THE BIOLOGICAL EFFECTS OF IONIZING RADIATIONS (I.E., THE BEIR V REPORT) INDICATES THAT THE BIOLOGICAL EFFECTS OF EXPOSURE TO LOW LEVELS OF RADIATION ARE GREATER THAN PREVIOUSLY ESTIMATED. ARE THERE LIKELY TO BE ANY CHANGES IN FEDERAL LIMITS ON PERMISSIBLE LEVELS OF RADIATION EXPOSURE TO WORKERS OR THE GENERAL PUBLIC AS A RESULT OF THIS STUDY? WHAT IMPACT DO THESE RESULTS HAVE ON THE PROPOSED ACTION?

RESPONSE: THE RECENTLY ISSUED BEIR V STUDY INCLUDES A DETAILED DESCRIPTION OF CURRENT DATA ON THE HEALTH RISKS OF EXPOSURE TO LOW LEVELS OF IONIZING RADIATION. THIS STUDY ESTIMATES THAT THE HEALTH RISK IS ABOUT THREE TIMES GREATER THAN ESTIMATED IN THE PREVIOUSLY ISSUED BEIR III REPORT. HOWEVER, IT SHOULD BE NOTED THAT THE DATA USED TO REACH THESE CONCLUSIONS HAVE LIMITATIONS, AS NOTED IN THE BEIR V STUDY. ASSESSMENT OF THE CARCINOGENIC RISKS THAT MAY BE ASSOCIATED WITH LOW DOSES OF RADIATION WERE EXTRAPOLATED FROM EFFECTS OBSERVED AT DOSES LARGER THAN 10 REM DELIVERED OVER A SHORT PERIOD OF TIME. IN ADDITION,

IT WAS NECESSARY TO USE ASSUMPTIONS ABOUT THE RELEVANT DOSE-EFFECT RELATIONSHIPS AND THE UNDERLYING MECHANISMS OF CARCINOGENESIS.

HEALTH HAZARDS ASSOCIATED WITH CHRONIC EXPOSURE TO LOW LEVELS OF IONIZING RADIATION HAVE BEEN STUDIED IN AREAS SUCH AS THOSE HAVING HIGH LEVELS OF BACKGROUND RADIATION, AREAS RECEIVING FALLOUT FROM NUCLEAR WEAPONS TESTING, AND AREAS NEAR NUCLEAR INSTALLATIONS. THE DATA FROM THESE STUDIES DO NOT INDICATE AN ELEVATED LEVEL OF CANCER RISK. HENCE, IT IS STILL NOT POSSIBLE TO DRAW DEFINITIVE CONCLUSIONS OF THE CANCER



RISKS ASSOCIATED WITH CHRONIC EXPOSURE TO LOW LEVELS OF IONIZING RADIATION.

THE PERMISSIBLE LEVEL OF RADIATION EXPOSURE FOR WORKERS IS BASED ON LIMITING THEIR HEALTH RISK TO LEVELS THAT ARE COMPARABLE TO THE OCCUPATIONAL RISKS FROM OTHER INDUSTRIES THAT ARE CONSIDERED TO BE SAFE. THE PERMISSIBLE LEVEL (5 REM/YR) MAY BE REDUCED AS A RESULT OF RECENT STUDIES THAT INDICATE THAT THE RISK FROM EXPOSURE TO LOW LEVELS OF IONIZING RADIATION IS HIGHER THAN PREVIOUS ESTIMATES. THE DOE AND OTHER FEDERAL AGENCIES ARE CURRENTLY EXAMINING THIS ISSUE. THE RADIATION DOSES TO WORKERS WHO WOULD IMPLEMENT THIS ACTION WOULD BE CONSIDERABLY BELOW CURRENT LIMITS.

THE RESULTS OF THE BEIR V STUDY ARE NOT EXPECTED TO RESULT IN SIGNIFICANT CHANGES IN THE PERMISSIBLE LEVELS OF RADIATION EXPOSURE TO THE GENERAL PUBLIC OR IN DOE CONCENTRATION LIMITS FOR RADIONUCLIDES IN LIQUID OR GASEOUS EFFLUENTS. THE RISK FACTORS PRESENTED IN THE BEIR V REPORT ARE CONSISTENT WITH THOSE USED BY THE EPA IN DEVELOPING REVISIONS TO THE NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS UNDER SECTION 112 OF THE CLEAN AIR ACT FOR RADIONUCLIDES AND THE US NUCLEAR REGULATORY COMMISSION (NRC) IN DEVELOPING REVISIONS TO 10 CFR 20 FOR PERMISSIBLE LEVELS OF RADIONUCLIDES IN AIR AND WATER IN CONTROLLED AND UNCONTROLLED AREAS. THE DOE STANDARDS ARE CONSISTENT WITH THOSE DEVELOPED BY THE EPA AND NRC.

A MAJOR ELEMENT OF THE DOE RADIATION PROTECTION PROGRAM FOR OCCUPATIONAL AND PUBLIC EXPOSURES IS AS LOW AS REASONABLY ACHIEVABLE (ALARA) CONCEPT. UNDER THE ALARA PROCESS, ALL EXPOSURES TO RADIATION AND ALL RELEASES OF RADIOACTIVITY TO THE ENVIRONMENT MUST BE REDUCED TO LEVELS THAT ARE AS LOW AS REASONABLY ACHIEVABLE. THE DOE IS COMMITTED TO THIS APPROACH. THE PROPOSED ACTION WOULD NOT BE IMPACTED EVEN IF MORE STRINGENT STANDARDS WERE IN EFFECT BECAUSE THE PREDICTED LEVELS OF RADIATION EXPOSURE TO WORKERS AND THE PUBLIC ARE WELL BELOW APPLICABLE STANDARDS.

ISSUE 20

COMMENT: TRANSPORTING THE WASTES BY TRUCK FROM THE QUARRY TO THE CHEMICAL PLANT AREA HAS THE POTENTIAL FOR SPREADING CONTAMINATION TO CURRENTLY CLEAN AREAS. HOW WILL THIS POSSIBLE SPREAD OF CONTAMINATION BE CONTROLLED?

RESPONSE: THE WASTES WILL BE TRANSPORTED TO THE CHEMICAL PLANT AREA IN TRUCKS THAT WILL TRAVEL AT LOW SPEEDS ALONG A DEDICATED HAUL ROAD. CURRENT PLANS ARE TO PACKAGE THE WASTES IN CONTAINERS TO ENSURE MINIMAL RELEASES DURING TRANSPORT. THE EXTERIORS OF THE TRUCKS WILL BE SURVEYED FOR CONTAMINATION BEFORE LEAVING THE QUARRY AND CHEMICAL PLANT AREA, AND ANY LOOSE CONTAMINATION WILL BE REMOVED BEFORE THE TRUCKS ARE ALLOWED TO EXIT EITHER AREA. FINALLY, PERIODIC SURVEYS OF THE HAUL ROAD WILL BE PERFORMED TO ENSURE THAT CONTAMINATION CONTROLS ARE EFFECTIVE. IF ANY CONTAMINATION IS DETECTED ON THE HAUL ROAD, THE AREA WILL BE CLEANED UP



IMMEDIATELY AND MEASURES WILL BE TAKEN TO PREVENT A REOCCURRENCE. THIS APPROACH WILL ENSURE THAT CONTAMINATION IS NOT BEING SPREAD TO THE ENVIRONMENT AS A RESULT OF WASTE RELOCATION.

ISSUE 21

COMMENT: AS CURRENTLY PLANNED, TRUCKS LEAVING THE QUARRY WOULD CROSS STATE ROUTE 94 NEAR THE QUARRY AND THEN PROCEED ALONG A DEDICATED HAUL ROAD TO THE CHEMICAL PLANT AREA. EMPTY TRUCKS WOULD RETURN TO THE QUARRY USING ROUTE 94. THE DOE SHOULD INVESTIGATE FURTHER THE USE OF GRADE SEPARATION (I.E., AN UNDERPASS) AT THE INTERSECTION OF STATE ROUTE 94 AND THE HAUL ROAD TO AVOID ANY CROSSING OF ROUTE 94 BY TRUCKS. IN ADDITION, PLANS SHOULD BE DEVELOPED TO MINIMIZE OR ELIMINATE TRUCK TRAFFIC ON ROUTE 94 DURING TIME PERIODS THAT BUS OR STUDENT TRAFFIC ARE ON THIS ROADWAY.

RESPONSE: THE DOE AGREES THAT TRANSPORTATION SAFETY IS ONE OF THE MOST SIGNIFICANT ISSUES ASSOCIATED WITH THIS ACTION. AS PRESENTED IN THE FS, WASTES WOULD BE LOADED DIRECTLY INTO TRUCKS. IN THIS APPROACH, THE RATE OF WASTE REMOVAL COULD BE LIMITED BY THE TIME REQUIRED FOR A TRUCK TO TRAVEL TO THE TEMPORARY STORAGE AREA AND RETURN TO THE QUARRY FOR ANOTHER LOAD. BY STAGING THE CONTAINERS AT THE QUARRY, AND USING THE TRUCKS ONLY TO SHUTTLE CONTAINERS BACK AND FORTH TO THE TEMPORARY STORAGE AREA, THE ENTIRE OPERATION CAN SUSTAIN THE EXTRA TIME REQUIRED FOR TRUCKS TO SHARE THE SINGLE LANE HAUL ROAD. TO PROVIDE FURTHER FLEXIBILITY, PLANS FOR THE HAUL ROAD COULD BE MODIFIED TO INCLUDE TURNOUTS WHICH, IN CONJUNCTION WITH RADIO CONTACT, WOULD ALLOW SAFE PASSAGE OF TRUCK TRAFFIC. THIS WOULD ELIMINATE ALL TRUCK TRAFFIC ON ROUTE 94.

IN ADDITION, DISCUSSIONS ARE CURRENTLY TAKING PLACE WITH THE STATE OF MISSOURI ON THE USE OF GRADE SEPARATION WHERE THE DEDICATED HAUL ROAD CROSSES STATE ROUTE 94. THIS WOULD ELIMINATE ALL CROSSING OF ROUTE 94 BY TRUCKS. USE OF GRADE SEPARATION WOULD REQUIRE RECONSTRUCTION OF A SECTION OF ROUTE 94. THE DECISION ON USE OF THIS OPTION WILL BE LARGELY DICTATED BY THE COST OF THE RECONSTRUCTION RELATIVE TO THAT ASSOCIATED WITH OTHER SAFETY MEASURES THAT COULD BE USED AT THIS CROSSING (E.G., FLAGMEN, TRAFFIC SIGNALS). THE DOE WILL CONTINUE WORKING WITH THE STATE TO RESOLVE THIS ISSUE.

ISSUE 22

COMMENT: WILL THIS ACTION HAVE ANY IMPACT ON WILDLIFE IN THE IMMEDIATE AREA?

RESPONSE: ACTIVITIES RELATED TO THIS ACTION WILL DESTROY ABOUT 15 HA (37 ACRES) OF VEGETATION AT THE QUARRY, ALONG THE HAUL ROAD, AND AT THE CHEMICAL PLANT AREA. SOME SMALL, RELATIVELY IMMOBILE WILDLIFE WILL BE LOST, AND OTHER MORE MOBILE WILDLIFE WILL BE DISTURBED, DISPLACED, AND POSSIBLY LOST DURING CONSTRUCTION AND OPERATION. HOWEVER, THE OVERALL



IMPACT WILL BE VERY MINOR GIVEN THE EXTENSIVE AMOUNT OF WILDLIFE HABITAT IN THE SURROUNDING AREA.

ISSUE 23:

COMMENT: THERE HAS BEEN A HIGHER INCIDENCE OF CHILDHOOD LEUKEMIA IN ST. CHARLES COUNTY THAN THAT EXPECTED IN THE GENERAL POPULATION. IT IS IMPERATIVE THAT THIS ACTION BE CONDUCTED IN A MANNER TO ENSURE THAT NO ADDITIONAL CANCERS WILL RESULT FROM REMOVING THE BULK WASTES FROM THE QUARRY AND TRANSPORTING THEM TO THE CHEMICAL PLANT AREA FOR TEMPORARY STORAGE.

RESPONSE: THE MISSOURI DEPARTMENT OF HEALTH RETROSPECTIVE CHILDHOOD LEUKEMIA STUDY DOES NOT SUPPORT THE CONTENTION THAT THERE ARE ELEVATED LEVELS OF CHILDHOOD LEUKEMIA IN ST. CHARLES COUNTY. THE STUDY INDICATES AN INCREASED LEVEL OF CHILDHOOD LEUKEMIA CASES DURING THE PERIOD OF 1975 THROUGH 1979, BUT THE INCIDENCE RATE OVER THE ENTIRE PERIOD OF THE STUDY (I.E., 1970 THROUGH 1983) WAS NOT STATISTICALLY DIFFERENT FROM THAT TO THE GENERAL POPULATION. THE DEPARTMENT OF HEALTH WAS NOT ABLE TO ESTABLISH A LINK BETWEEN THESE LEUKEMIA CASES AND ANY SPECIFIC CAUSE. THEY SPECIFICALLY RULED OUT EXPOSURE TO RELEASES FROM THE WELDON SPRING SITE.

EVEN THOUGH THE RISKS TO THE GENERAL PUBLIC FROM THIS ACTION ARE ESTIMATED TO BE VERY LOW, THE DOE, UNDER ITS ALARA PROCESS, WILL ENSURE THAT THE RISKS ARE REDUCED TO EXTREMELY LOW LEVELS. IT IS HIGHLY UNLIKELY THAT THERE WILL BE ANY HEALTH IMPACTS ASSOCIATED WITH RADIATION EXPOSURE RESULTING FROM THIS ACTION.

ISSUE 24

COMMENT: WHAT WILL BECOME OF THE QUARRY AFTER THE BULK WASTES HAVE BEEN REMOVED?

RESPONSE: AFTER THE BULK WASTES HAVE BEEN REMOVED, DETAILED STUDIES WILL BE PERFORMED TO EVALUATE THE NEED FOR ADDITIONAL REMEDIAL ACTION (SUCH AS THE REMOVAL OF RESIDUAL MATERIALS FROM THE CRACKS AND FISSURES IN THE QUARRY AND THE REMEDIATION OF CONTAMINATED GROUNDWATER). THE WATER TREATMENT PLANT AT THE QUARRY WILL CONTINUE TO OPERATE TO KEEP THE QUARRY POND FROM REFILLING. AFTER ALL NECESSARY REMEDIAL ACTIONS ARE

COMPLETE, THE QUARRY AREA WILL BE STABILIZED. PLANS FOR STABILIZING THIS AREA WILL BE PREPARED COOPERATIVELY WITH STATE OF MISSOURI AGENCIES SUCH AS THE MISSOURI DEPARTMENTS OF NATURAL RESOURCES AND CONSERVATION TO ENSURE THAT FUTURE USES OF THE QUARRY AREA ARE CONSISTENT WITH THOSE PLANNED FOR THE SURROUNDING WELDON SPRING WILDLIFE AREA.

ISSUE 25

COMMENT: HOW DO WE KNOW THAT SUFFICIENT FUNDS WILL BE AVAILABLE TO COMPLETE ALL NECESSARY REMEDIAL ACTIONS.



RESPONSE: FUNDING FOR REMEDIATION OF THE WELDON SPRING SITE IS PROVIDED BY CONGRESS ON ANNUAL BASIS. THERE IS NO GUARANTEE THAT ALL REQUIRED FUNDS WILL BE MADE AVAILABLE EACH AND EVERY YEAR. HOWEVER, CLEANUP PROJECTS SUCH AS THAT AT THE WELDON SPRING SITE ARE CURRENTLY TOP PRIORITY ACTIVITIES WITHIN THE DOE. IN ADDITION, BECAUSE THE SITE IS ON THE NATIONAL PRIORITIES LIST (NPL), EPA REGION VII IS RESPONSIBLE FOR ENSURING THE ADEQUACY OF THE CLEANUP. REPRESENTATIVES FROM EPA REGION VII HAVE MADE IT VERY CLEAR THAT THEY WILL NOT DELIST THE SITE FROM THE NPL UNTIL THEY ARE SATISFIED THAT ALL REQUIRED REMEDIAL ACTIONS HAVE BEEN COMPLETED.

ISSUE 26

COMMENT: THE PROPOSED PLAN STATES THAT ALTERNATIVE 5 IS PREFERRED BY THE DOE. HAS THE DOE ALREADY DECIDED ON IMPLEMENTING THIS ALTERNATIVE?

RESPONSE: THE DOE HAD NOT YET REACHED A DECISION ON IMPLEMENTING ALTERNATIVE 5 WHEN THE PROPOSED PLAN WAS ISSUED TO THE PUBLIC. HOWEVER, THIS ALTERNATIVE WAS PREFERRED BY THE DOE. THIS JOINT EPA/DOE RECORD OF DECISION PROVIDES THE RATIONALE FOR SELECTION OF THIS ALTERNATIVE.

ISSUE 27

COMMENT: THE DOE HAS APPARENTLY ALREADY CONCLUDED THAT TRUCK TRANSPORT OF THE BULK WASTES IS THE PREFERRED MODE OF TRANSPORTATION. ADDITIONAL CONSIDERATION SHOULD BY GIVEN TO USING THAT EXISTING RAIL SPUR BETWEEN THE QUARRY AND CHEMICAL PLANT AREA.

RESPONSE: THE EXISTING RAIL SPUR BETWEEN THE QUARRY AND CHEMICAL PLANT AREA IS IN A STATE OF DISREPAIR AND WOULD REQUIRE A SIGNIFICANT AMOUNT OF EFFORT (AND COST) TO UPGRADE FOR USE. THE RESULTS OF A RECENT DETAILED COST ESTIMATE INDICATE THAT THE RAIL OPTION WOULD COST ABOUT $1 MILLION MORE THAN THE HAUL ROAD OPTION. IN ADDITION, THIS RAIL SPUR CROSSES STATE ROUTE 94 THREE TIMES BETWEEN THE QUARRY AND CHEMICAL PLANT AREA. EACH CROSSING PRESENT A SAFETY CONCERN. THE WASTES CAN BE SAFELY AND EFFICIENTLY TRANSPORTED BY TRUCK ALONG A DEDICATED HAUL ROAD THAT WILL BE CONSTRUCTED USING PORTIONS OF THE EXISTING RAIL SPUR. THIS DEDICATED HAUL ROAD WILL CROSS STATE ROUTE 94 ONLY ONCE (NEAR THE QUARRY). DISCUSSIONS ARE CURRENTLY TAKING PLACE WITH THE STATE OF

MISSOURI ON THE USE OF GRADE SEPARATION WHERE THE HAUL ROAD CROSSES ROUTE 94. THIS WOULD ELIMINATE ANY CROSSING OF ROUTE 94 BY TRUCKS.

ISSUE 28

COMMENT: THE SORTING PAD AT THE TEMPORARY STORAGE AREA SHOULD BE COMPLETELY ENCLOSED AND VENTILATED TO MINIMIZE AIRBORNE RELEASES OF CONTAMINANTS. IN ADDITION, THE ENTIRE QUARRY AREA SHOULD BE ENCLOSED DURING REMOVAL OF THE BULK WASTES.



RESPONSE: THE NEED FOR AN EXTENSIVE SORTING PAD AT THE TEMPORARY STORAGE AREA IS BEING REEVALUATED BECAUSE THE CURRENT PLAN IS TO CONDUCT BASIC WASTE SORTING AT THE QUARRY. ALTHOUGH SOME SORTING MAY STILL BE REQUIRED AT THE TEMPORARY STORAGE AREA, ENCLOSING THE SORTING PAD WITH AN ENGINEERED STRUCTURE IS PROBABLY UNNECESSARY. HOWEVER, THIS CONSIDERATION WILL BE EVALUATED AS ENGINEERING DESIGN PROCEEDS.

ENCLOSING THE ENTIRE QUARRY DURING EXCAVATION OF THE BULK WASTES WAS CONSIDERED IN THE PRELIMINARY ENGINEERING REPORT AND REJECTED DUE TO ITS HIGH COST. IN ADDITION, THERE IS SIMPLY NO NEED TO ENCLOSE THE QUARRY TO REMOVE THE WASTES SAFELY. RADON AND DUST SUPPRESSION MEASURES WILL BE IMPLEMENTED TO ENSURE THAT RELEASES OF HAZARDOUS CONTAMINANTS TO THE ATMOSPHERE WILL BE LOW AND NOT PRESENT A HEALTH RISK TO NEARBY INDIVIDUALS.

#TA

TABLE 2:
CONCENTRATIONS OF RADIONUCLIDES IN THE QUARRY BULK WASTES

| RADIONUCLIDE | BULK WASTE CONCENTRATION (PCI/G) RANGE | AVERAGE |
|---|---|---|
| URANIUM-238 | 1.4 - 2,400 | 200 |
| THORIUM-238 | 0.7 - 36 | 26 |
| THORIUM-230 | 0.7 - 6,800 | 330 |
| RADIUM-228 | 0.1 - 2,200 | 96 |
| RADIUM-226 | 0.2 - 2,800 | 110 |

| RADIONUCLIDE | AVERAGE SURFICIAL CONCENTRATION(A) (PCI/G) | AVERAGE BACKGROUND CONCENTRATION |
|---|---|---|
| URANIUM-238 | 170 | 1.3 |
| THORIUM-238 | (B) | 1.0 |
| THORIUM-230 | 150 | 1.3 |

| | | |
|---|---|---|
| RADIUM-228 | 20 | 1.0 |
| RADIUM-226 | 110 | 0.9 |

(A) - SAMPLES OBTAINED FROM THE TOP 15 CM (6 IN.) OF THE QUARRY BULK WASTES.

(B) - NO DATA AVAILABLE

TABLE 5:

1
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CONCENTRATIONS OF NITROAROMATIC COMPOUNDS
IN SURFACE SOILS AT THE QUARRY(A)

| NITROAROMATIC COMPOUND | CONCENTRATION (MG/KG) RANGE | AVERAGE |
|---|---|---|
| 2,4,6-TNT | 4,900-20,000 | 13,000 |
| 2,4-DNT | 6.6-29 | 18 |
| 2,6-DNT | LT 1.2-8.6 | 5.0 |
| NITROBENZENE | 8.4-130 | 78 |
| 1,3,5-TRINITROBENZENE | 18-280 | 140 |
| 1,3-DINITROBENZENE | LT.0.8(B) | -- |

(A) THREE SURFACE SAMPLES WERE TAKEN FROM THE EXPOSED SLOPE IN THE NORTHEASTERN CORNER OF THE QUARRY.
(B) LOWER LIMIT OF DETECTION.

TABLE 6:
CARCINOGENIC RISKS AND HEALTH HAZARD
INDEXES FOR THE PASSERBY AND TRESPASSER SCENARIOS

| EXPOSURE SCENARIO/CASE | INDEX FOR CARCINOGENIC RISKS RADIOLOGICAL(A) | CHEMICAL(B) | HEALTH HAZARD NONCARCINOGENIC EFFECTS(C) |
|---|---|---|---|
| PASSERBY | | | |
| REPRESENTATIVE | 4.2 X (10-6) | 1.0 X (10-9) | 1.0 X (10-3) |
| PLAUSIBLE MAXIMUM | 1.2 X (10-5) | 3.0 X (10-9) | 1.6 X (10-3) |
| TRESPASSER | | | |
| REPRESENTATIVE | 6.0 X (10-6) | 4.3 X (10-6) | 2.0 |
| PLAUSIBLE MAXIMUM | 8.7 X (10-5) | 3.6 X (10-5) | 8.5 |

(A) RISK OF A FETAL CANCER; THE RATE OF CANCER INDUCTION WILL BE

HIGHER.

(B) RATE OF CANCER INDUCTION. THE NCP ESTABLISHES THAT, FOR KNOWN OR SUSPECTED CARCINOGENS, ACCEPTABLE EXPOSURE LEVELS ARE GENERALLY CONCENTRATION LEVELS THAT REPRESENT AN EXCESS UPPER BOUND LIFETIME CANCER RISK TO AN INDIVIDUAL OF BETWEEN (10-4) AND (10-6) USING INFORMATION ON THE RELATIONSHIP BETWEEN DOSE AND RESPONSE.

(C) THE HEALTH HAZARD INDEX IS A MEASURE OF THE POTENTIAL FOR ADVERSE CHRONIC HEALTH EFFECTS OTHER THAN CANCER. A VALUE GREATER THAN 1



INDICATES A POTENTIAL FOR ADVERSE HEALTH EFFECTS.

# *WELDON SPRING QUARRY/PLANT/PITS (USDOE/ARMY)*

## Site Information:

**Site Name:** WELDON SPRING QUARRY/PLANT/PITS (USDOE/ARMY)
**Address:** ST. CHARLES COUNTY, MO

**EPA ID:** MO3210090004
**EPA Region:** 07

## Record of Decision (ROD):

**ROD Date:** 09/27/1993
**Operable Unit:** 01
**ROD ID:** EPA/ROD/R07-93/067

**Media:** Soil, Sediment, Debris, Sludge

**Contaminant:** Organics, Metals, Inorganics, Radioactive Materials

**Abstract:** The 223-acre Weldon Spring Quarry/Plant/Pits (USDOE) is an inactive chemical plant and lime quarry located in St. Charles County, Missouri. The site consists of 40 buildings, the 26-acre raffinate pits, the 11-acre Ash Pond, the 0.7-acre Frog Pond, two former dump areas, a woodlands area, and a wetlands area. Land use in the area is predominantly agricultural, with two conservation and wildlife areas and a U.S. Army Reserve and National Guard Training Center located adjacent to the site. There are two aquifers, a shallow and a deep aquifer, underlying the site, and a small northern portion of the site lies within the 100-year floodplain of Schote Creek. An estimated 850 people reside two miles from the site. From 1941 to 1946, the U.S. Army operated the Weldon Springs Ordnance Works onsite, producing explosives such as TNT and DNT. In 1949, 15,000 acres were transferred to the State and the University of Missouri for use as a wildlife area and agricultural land. In 1955, the U.S. Atomic Energy Commission (AEC), a predecessor to USDOE, acquired 205 acres of the site from the Army to construct a uranium feed materials plant. From 1957 to 1966, the AEC processed uranium and thorium ore concentrates at the plant and disposed of radioactive-and chemically-contaminated waste, such as uranium, metals, and PCBs, onsite in the fourth raffinate pit and the quarry. The four raffinate pits were excavated from existing soil during the operation period of the chemical plant to receive waste slurry from the processing operations. These pits constitute the most heavily contaminated area

of the site and contain approximately 200,000 yd[3] of sludge and 57,000,000 gallons of water. Plant operations generated several chemical and radioactive waste streams, including raffinates from the refinery operation and washed slag from the uranium recovery process. Waste slurries were piped to the raffinate pits, where the solids settled to the bottom and the supernatant liquids were decanted to the plant process sewer, which drained offiste into the Missouri River. In 1967, the Army reacquired the chemical plant property and began decontaminating and dismantling operations to prepare the facility for herbicide production. In 1969, this project was canceled, and the plant has remained unused since that time. In 1971, the Army returned the raffinate pits portion of the chemical plant area to the AEC, and the remainder of the property to USDOE in 1985. In 1986, USDOE initiated cleanup activities, including several interim response actions. A 1990 ROD addressed the removal and temporary storage of the quarry bulk wastes onsite. This interim ROD addresses the contaminated source area at the chemical plant and the disposal of the material that may be generated by upcoming actions. The primary contaminants of concern affecting the soil, sediment, debris, and sludge are other organics, including PAHs and PCBs; metals, including arsenic, chromium, and lead; other inorganics, including asbestos; and radioactive materials. SELECTED REMEDIAL ACTION: The selected interim remedial action for this site includes constructing a new sludge processing facility, a volume reduction facility, and an engineered disposal facility onsite; excavating or dredging approximately 339,000 yd[3] of contaminated soil, 119,800 yd[3] of contaminated sediment, and 220,000 yd[3] of contaminated sludge and transporting them to the onsite treatment facility; treating the contaminated soil, sediment, and sludge onsite using solidification/stabilization in the sludge processing facility and disposing of the resultant material onsite; performing volume reduction operations; backfilling, regrading, and vegetating the excavated areas with clean soil; disposing of the excavated material not targeted for onsite treatment in the onsite disposal facility; treating approximately 30,650 yd[3] of contaminated vegetation onsite using biodegradation, followed by onsite disposal; treating approximately 3,960 yd[3] of containerized process chemicals onsite in the sludge processing facility using stabilization or neutralization, or incinerating them offsite; decontaminating approximately 169,600 yd[3] of structural debris onsite, with on- or offsite disposal; conducting pilot-scale, bench-scale, and leachability tests; usinggrout material from the mixing of raffinate sludge for grouting voids in debris at the onsite disposal cell for the sludge treatment process; capping the engineered disposal facility with a long-term RCRA cover and a leachate collection system; providing for a contingency remedy using vitrification of the contaminated sludge, soil, and

sediment, if solidification/stabilization proves to be ineffective during pilot-scale testing; and monitoring the ground water, surface water, and air to facilitate protection of the general public and the environment. The estimated present worth cost for this remedial action is $78,500,000, which includes an estimated total O&M cost of $23,900,000 for 30 years. The estimated present worth cost for the contingency remedy is $96,900,000, which includes an estimated total O&M cost of $23,900,000 for 30 years. PERFORMANCE STANDARDS OR GOALS: Soil, sediment, sludge, and debris cleanup goals are based on State and FederalARARs and an excess incremental cancer risk level of 10[6]. Chemical- specific soil cleanup goals include Ra[-226] 6.2 pCi/g; Ra[-228] 6.2 pCi/g; Th[-230] 6.2 pCi/g; Th[-232] 6.2 pCi/g; U[-238] 120 pCi/g; arsenic 75 mg/kg; chromium (total) 110 mg/kg; chromium VI 100 mg/kg; lead 450 mg/kg; thallium 20 mg/kg; benz(a)anthracene 5.6 mg/kg; benzo(b)fluoranthene 5.6 mg/kg; benzo(k)fluoranthene 5.6 mg/kg; benzo(a)pyrene 5.6 mg/kg; chrysene 5.6 mg/kg; indeno(1,2,3cd)pyrene 5.6 mg/kg; PCBs 8 mg/kg; and TNT 140 mg/kg. While these levels were developed to ensure that cleanup is successful, the remedial action will aim to reach levels as low as reasonably achievable (ALARA) during field excavation activities. Certain State and Federal regulatory requirements under NESHAPs, RCRA, and TSCA were waived underCERCLA, Section 121 (d)(4)(A-D). ALARA goals include Ra[-226] 5 pCi/g; Ra[- 228] 5 pCi/g; Th[-230] 5 pCi/g; Th[-232] 5 pCi/g; and U[-238] 30 pCi/g; arsenic 45 mg/kg; chromium (total) 90 mg/kg; chromium VI 90 mg/kg; lead 240 mg/kg; thallium 16 mg/kg;PAHs 0.44 mg/kg; PCBs 0.65 mg/kg; and TNT 14 mg/kg. Chemical-specific sediment, sludge, and debris cleanup goals were not provided. INSTITUTIONAL CONTROLS: Not applicable.

**Remedy:**

The chemical plant operable unit remedial action is the third of five major response actions planned for the chemical plant area. Previous response actions included a removal action involving the decontamination and dismantlement of site structures with short-term storage of the material on site until selection of a disposal option in this ROD and a removal action to treat impounded surface water. In addition, bulk waste material from the Weldon Spring Quarry is being placed in temporary storage on site until the selection of a disposal option.

This operable unit addresses the various sources of contamination at the chemical plant area including soils, sludge, sediment, and materials placed in short-term storage as a result of previous response actions.

This remedial action uses treatment to address the principal threat remaining at the site, (e.g., raffinate pit sludges and certain soil from the quarry).

The major components of this remedy are:
- Dredge sludge from the raffinate pits, excavate sediment from Frog Pond and Ash Pond and three off-site lakes, and excavate soil from specific locations (including two former dump areas, locations adjacent to the chemical plant buildings on site, and 10 vicinity properties off site) using standard construction equipment and procedures.
- Remove material stored at the temporary facilities on site (including bulk waste excavated from the quarry, treatment residuals from the water treatment plants at the quarryand the chemical plant area, and building material from the chemical plant area) using standard construction equipment and procedures.
- Certain contaminated materials such as the raffinate pit sludges and portions of quarry soil will be treated on site by chemical stabilization/solidification.
Treated and untreated materials will be disposed of on site in a facility designed and constructed specifically for the Weldon Spring site wastes.
- Continued evaluation of vitrification as a contingency treatment option.

In reaching the decision to implement this remedial alternative, DOE evaluated three other alternatives in addition to no action. The other alternatives are: (1) Removal, Vitrification, and Disposal Onsite; (2) Removal, Vitrification, and Disposal at the Envirocare Facility; and (3) Removal Vitrification, and Disposal at the Hanford Reservation Facility. A description of the alternatives is provided in the Decision Summary of the ROD (attached), and is available in the Administrative Record. CERCLA's nine criteria (two threshold, five primary balancing, and two modifying criteria) set out in the NCP were used to evaluate the alternatives. The selected remedy and the contingency treatment option represent the best balance of key factors with respect to these criteria and are the environmentally preferable alternatives.

Short-term effectiveness, implementability, and cost are the key factors for selection of the preferred alternative. The short-term effectiveness of the selected remedy is greater than for the two alternatives that involve transportation of the waste to off-site locations. The selected remedial action is the most implementable of all the alternatives evaluated in detail because the chemical stabilization/solidification technology has been utilized at othersites

and would use readily available resources. Finally, the selected remedy is the most cost effective of those alternatives evaluated.

**Text:** Full-text ROD document follows on next page.

Text:
RECORD OF DECISION: DOE/OR/21548-376

# Record of Decision for Remedial Action at the Chemical Plant Area of the Weldon Spring Site

September 1993

prepared by

U.S. Department of Energy, Oak Ridge Field Office, Weldon Spring Site Remedial Action Project

## DECLARATION

### SITE NAME AND LOCATION

Weldon Spring Site
St. Charles County, Missouri 63304

### STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the chemical plant area of the Weldon Spring site in St. Charles County, Missouri. This remedial action was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300.

In making this decision, it is the U.S. Department of Energy's (DOE's) policy to integrate National Environmental Policy Act (NEPA) values into the CERCLA remedial action process; however, it is not the intent of the DOE to make a statement on the legal applicability of the NEPA to CERCLA actions. This single document is intended to serve as the DOE's Record of Decision (ROD) under both the CERCLA and the NEPA.

The decision presented herein is based on the information available in the Administrative Record maintained in accordance with the CERCLA. The decision is also based on the issuance of the Proposed Plan for Remedial Action at the Chemical Plant Area of the Weldon Spring Site (DOE 1992a), holding a public meeting to receive comments on the Proposed Plan, and completion of the Remedial Investigation/Feasibility Study-Final Environmental Impact Statement (RI/FS-Final EIS). In addition, the DOE has considered all comments received on the Proposed Plan and the RI/FS-Final EIS documents in the preparation of the ROD.

As the lead agency for the State of Missouri regarding the Weldon Spring Site Remedial Action Project, the Missouri Department of Natural Resources concurs that Alternative 6a: Removal, Chemical Stabilization/Solidification and Disposal On Site is the preferred remedy for the chemical plant area of the Weldon Spring site, and also concurs with applicable and/or relevant and appropriate requirements (ARARs) and waivers.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in the ROD, may present a threat to human health and the environment.

DESCRIPTION OF THE REMEDY

The chemical plant operable unit remedial action is the third of five major response actions planned for the chemical plant area. Previous response actions included a removal action involving the decontamination and dismantlement of site structures with short-term storage of the material on site until selection of a disposal option in this ROD and a removal action to treat impounded surface water. In addition, bulk waste material from the Weldon Spring Quarry is being placed in temporary storage on site until the selection of a disposal option.

This operable unit addresses the various sources of contamination at the chemical plant area including soils, sludge, sediment, and materials placed in short-term storage as a result of previous response actions.

This remedial action uses treatment to address the principal threat remaining at the site, (e.g., raffinate pit sludges and certain soil from the quarry). The major components of this remedy are:

- Dredge sludge from the raffinate pits, excavate sediment from Frog Pond and Ash Pond and three off-site lakes, and excavate soil from specific locations (including two former dump areas, locations adjacent to the chemical plant buildings on site, and 10 vicinity properties off site) using standard construction equipment and procedures.

- Remove material stored at the temporary facilities on site (including bulk waste excavated from the quarry, treatment residuals from the water treatment plants at the quarry and the chemical plant area, and building material from the chemical plant area) using standard construction equipment and procedures.

- Certain contaminated materials such as the raffinate pit sludges and portions of quarry soil will be treated on site bychemical stabilization/solidification. Treated and untreated materials will be disposed of on site in a facility designed and constructed specifically for the Weldon Spring site wastes.

- Continued evaluation of vitrification as a contingency treatment option.

In reaching the decision to implement this remedial alternative, DOE evaluated three other alternatives in addition to no action. The other alternatives are: (1) Removal, Vitrification, and Disposal On-site; (2) Removal, Vitrification, and Disposal at the Envirocare Facility; and (3) Removal Vitrification, and Disposal at the Hanford Reservation Facility. A description of the alternatives is provided in the Decision Summary of the ROD (attached), and is available in the Administrative Record. CERCLA's

nine criteria (two threshold, five primary balancing, and two modifying criteria) set out in the NCP were used to evaluate the alternatives. The selected remedy and the contingency treatment option represent the best balance of key factors with respect to these criteria and are the environmentally preferable alternatives.

Short-term effectiveness, implementability, and cost are the key factors for selection of the preferred alternative. The short-term effectiveness of the selected remedy is greater than for the two alternatives that involve transportation of the waste to off-site locations. The selected remedial action is the most implementable of all the alternatives evaluated in detail because the chemical stabilization/solidification technology has been utilized at other sites and would use readily available resources. Finally, the selected remedy is the most cost effective of those alternatives evaluated.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment; it complies with Federal and State of Missouri requirements that arelegally applicable or relevant and appropriate to the remedial action, except as specifically waived pursuant to CERCLA, as set forth below, and is cost effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, and satisfies the CERCLA statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

The following Federal and State of Missouri requirements are waived under this Record of Decision:

- 19 CSR 20-10.040 - State Rn-222 limit of 1 pCi/l above background in uncontrolled areas. CERCLA provision for waiver: Section 121(d)(4)(C).

- 40 CFR Part 268, Subpart E - Land Disposal Restrictions (LDR) storage limitations. CERCLA provision for waiver: Section 121(d)(4)(C).

- 40 CFR Part 268, Subpart C - LDR placement restrictions. CERCLA provision for waiver: Section 121(d)(4)(A).

- 10 CSR 25.5-262(2)(C)1 - packaging, marking, and labeling requirements. CERCLA provision for waiver: Section 121(d)(4)(A) and Section 121(d)(4)(B).

- 40 CFR 761.75(b)(3) - Toxic Substance Control Act (TSCA) requirements for bottom landfill liner. CERCLA provision for waiver: Section 121(d)(4)(D).

- 40 CFR 264.314(f) - restrictions regarding free liquids in CSS grout placed in the disposal facility for purposes of disposing of CSS treated wastes and to fill voids of dismantlement debris. CERCLA provisions for waiver: Section 121(d)(4)(B) and Section 121(d)(4)(D).

- 40 CFR Part 268.42, Subpart D - LDR treatment standards based upon use of a specified technology. CERCLA provision for waiver: Section 121(d)(4)(D).

- 40 CFR 61, Subpart M - National Emission Standards for Hazardous Air Pollutants (NESHAPs) requirements for asbestos storage. CERCLA provision for waiver: Section 121(d)(4)(B).

- 40 CFR 761.65(a) - TSCA requirement for PCB storage and disposal. CERCLA provision for waiver: Section 121(d)(4)(A).

Because both the selected and contingency remedies would result in hazardous substances remaining on site above health-based levels (within the engineered disposal facility), a review will be conducted within five years after this remedial action is complete in accordance with CERCLA to ensure that the remedy continues to provide adequate protection of human health and the environment.

All practicable means to avoid or minimize environmental harm from implementation of the selected remedy have been adopted. Excavation of contaminated soil in an area extending into the Schote Creek 100year floodplain will be conducted using sediment controls to minimize off-site transport of contaminated materials and no net change in flood potential is expected due to these actions. A mitigation action plan will be prepared for dredging and excavation activities in areas considered to be wetlands to minimize adverse impacts. Final site layout and design will include all practicable means (e.g., sound engineering practices and proper construction practices) to minimize environmental impacts.

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DECISION SUMMARY

## 1 SITE NAME, LOCATION, AND DESCRIPTION

The Weldon Spring site is located in St. Charles County, Missouri, about 48 km (30 mi) west of St. Louis (Figure 1-1). The site consists of two geographically distinct areas: the 88-ha (217-acre) chemical plant area, which is about 3.2 km (2 mi) southwest of the junction of Missouri (State) Route 94 and U.S. Route 40/61, and a 3.6-ha (9-acre) limestone quarry, which is about 6.4 km (4 mi) south-southwest of the chemical plant area. The chemical plant area and the quarry are accessible from State Route 94, and both are fenced and closed to the public. This remedial action addresses sources of contamination at the chemical plant area, hereafter referred to as "the site," and its vicinity. This action also represents the selected disposal option for contaminated bulk waste material from the quarry and vicinity areas.

The site was initially used by the Army during the 1940s to produce the explosives trinitrotoluene (TNT) and dinitrotoluene (DNT). After extensive demolition, decontamination, and regrading, the chemical plant was built by the U.S. Atomic Energy Commission (AEC, a predecessor of the U.S. Department of Energy [DOE]) to process uranium and thorium ore concentrates during the 1950s and 1960s. Radioactively and chemically contaminated waste was disposed of at the site during this period, and waste was disposed of in the quarry by both the Army and the AEC from the 1940s through the 1960s. Radioactive contaminants are primarily radionuclides of the natural uranium and Th-232 decay series; chemical contaminants include naturally occurring metals and inorganic anions, as well as organic compounds such as polychlorinated biphenyls (PCBs) and nitroaromatic compounds.

Site features include about 40 buildings (currently being dismantled), four raffinate pits, two ponds (Ash Pond and Frog Pond), and two former dump areas (north dump and south dump) (Figure 1-2). Most of the land surface around the buildings is paved or covered with gravel; the remainder of the site contains a variety of grasses and scattered small shrubs and trees. Much of the site is routinely mowed, and little undisturbed and/or natural habitat exists except in the northern quadrant. Soil in the two dump areas and at scattered locations throughout the chemical plant is radioactively contaminated; discrete locations also contain elevated concentrations of certain metals and a few organic compounds. Portions of the site are classified as prime farmland soil by the U.S. Soil Conservation Service on the basis of soil type, slope, and drainage.

The raffinate pits cover about 10 ha (26 acres) in the southwestern portion

of the site. They were excavated from existing soil during the operational period of the chemical plant to receive waste slurry from the processing operations. These pits constitute the most heavily contaminated area and contain about 150,000 m[3] (200,000 yd[3]) of sludge and a combined average 216,000 m[3] (57,000,000 gal) of water. In addition, some drums and rubble from the Army's earlier decontamination activities at the chemical plant were disposed of primarily in the fourth pit.

Ash Pond covers about 4.5 ha (11 acres) in the northwestern portion of the site. This area received fly ash from the steam plant during the operational period. Frog Pond covers about 0.3 ha (0.7 acres) in the northeastern part of the site and served as a settling basin for flows from the pilot plant. The combined volume of surface water in these ponds averages about 8,700 m[3] (2,300,000 gal). The four pits and two ponds combined cover about 15 ha (38 acres) and are included on the Wetlands Inventory Map produced by the U.S. Department of the Interior.

The site is transacted by a surface water divide (Figure 1-3), and the natural land surface is gently sloping. Surface runoff from the southern portion of the site flows south toward the Missouri River via a 2.4-km (1.5-mi) natural channel referred to as the Southeast Drainage; runoff from the remainder ofthe site flows north toward the Mississippi River. Soil in the Southeast Drainage is radioactively contaminated as a result of past discharges, and intermittent flows continue to carry contaminants off site from surface runoff down the channel. A small portion (about 0.5 ha [1.3 acres]) of the northern area of the site along the drainage leading off site from Ash Pond is within the 100-year floodplain of Schote Creek, a perennial stream west and north of the site. The affected area represents a very small fraction (<0.01%) of that floodplain. Contaminant levels in site runoff have recently decreased as a result of interim actions to divert surface flow around contaminated soil areas such as the south dump and to remove suspended solids using a siltation pond, straw, and vegetative cover.

The site is also situated atop a groundwater divide. Groundwater in the shallow Burlington Keokuk Limestone aquifer south of the divide flows toward the Missouri River, and groundwater north of the divide flows north toward the Mississippi River. Groundwater in this shallow aquifer beneath the site and the nearby area (e.g., the Army property) is contaminated with nitrates, sulfates, nitroaromatic compounds, some heavy metals, and uranium. No drinking-water wells are currently completed in this aquifer, either on site or in the immediate vicinity. The limited data available for the deep, productive St. Peter Sandstone indicate that groundwater in this aquifer is not contaminated.

About 22 ha (55 acres) in the northern quadrant of the site have been relatively undisturbed and are essentially grassland/old-field habitat with some secondary forest growth. A wide variety of species occurs on site, especially in this northern portion. Deer, rabbits, raccoons, squirrels, turtles, frogs, wild turkeys, geese, and ducks have been observed. The site does not provide critical habitats for any Federal-listed threatened or endangered species, and no Federally listed species have been sighted in the chemical plant area. Two State-listed species, the pied-billed grebe (a State rare species) and the Swainson's hawk (a State endangered species) have been reported for the site, although there is no evidence that either

species breeds on or uses the site year-round.

The site is bordered by the August A. Busch Conservation Area to the north, the Weldon Spring Conservation Area to the south and east, and the U.S. Army Reserve and National Guard Training Area to the west (Figure 1-4). The two wildlife areas are managed by the Missouri Department of Conservation and are open throughout the year for recreational uses; together, these areas receive about 1,200,000 visitors each year. Army reserve troops had previously used the Army property each year, primarily for weekend training exercises. This Army property and portions of the wildlife areas constitute the balance of the former ordnance works and are also listed on the National Priorities List (NPL). Soil at several small locations on the Army property and in the two wildlife areas contains generally low levels of radioactivity as a result of previous site activities. Three lakes in the Busch Conservation Area also contain low levels of radioactivity as a result of surface runoff. These lakes also show elevated levels of lead, barium, and arsenic, although there is no known source from the site.

A State of Missouri highway maintenance facility is located on State Route 94, just northeast of the site entry gate, and Francis Howell High School is located about 1 km (0.6 mi) east of the site (Figure 1-4). The maintenance facility employs nine staff and one mechanic. The school employs about 160 faculty and staff, and about 1,600 students currently attend. The two closest communities to the site are Weldon Spring and Weldon Spring Heights; they are located about 3.2 km (2 mi) east of the site and have a combined population of about 850. Three residences are located within this 3.2 km (2 mi) distance from the site, the closest of which is a trailer occupied by the janitor at the high school. The largest city in the county is St. Charles; it is located about 24 km (15 mi) northeast of the site and has a population of about 50,000.

## 2 SITE HISTORY

In April 1941, the U.S. Department of the Army acquired about 7,000 ha (17,000 acres) of land in St. Charles County, Missouri, to construct the Weldon Spring Ordnance Works - a production facility for trinitrotoluene (TNT) and dinitrotoluene (DNT) explosives. The facility began operations in 1941 and closed in 1946. By 1949, all but about 810 ha (2,000 acres) of the ordnance works property had been transferred to the State of Missouri and the University of Missouri for use as wildlife area and agricultural land. Except for several small parcels transferred to St. Charles County, the remaining property became the chemical plant area of the Weldon Spring site and the adjacent U.S. Army Reserve and National Guard Training Area.

In May 1955, the U.S. Atomic Energy Commission (AEC) acquired 83 ha (205 acres) of the property from the Army for construction of a uranium feed materials plant. An additional 6 ha (15 acres) was later transferred to the AEC for expansion of waste storage capacity; i.e., to construct the fourth raffinate pit. Considerable explosives decontamination and regrading activities were conducted prior to constructing the chemical plant. Uranium and thorium ore concentrates were processed at the plant from 1957 to 1966.

Plant operations generated several chemical and radioactive waste streams, including raffinates from the refinery operation and washed slag from the

uranium recovery process. Waste slurries were piped to the raffinate pits, where the solids settled to the bottom and the supernatant liquids were decanted to the plant process sewer. This sewer drained off site to the Missouri River via the Southeast Drainage. Some solid waste was also disposed of on site during the plant's operational period. The quarry, which had been used by the Army since the early 1940s to dispose of chemically contaminated waste, was transferred to the AEC in July 1960. Radioactively contaminated wastes such as uranium and thorium residues, building rubble, and process equipment were disposed of in the quarry through 1969.

The Army reacquired the chemical plant property in 1967 and began decontamination and dismantling operations to prepare the facility for herbicide production. Much of the resultant debris was placed in the quarry; a small amount was also placed in the fourth raffinate pit. The project was canceled in 1969 prior to any production, and the plant has remained essentially unused and in caretaker status since that time. The Army returned the raffinate pits portion of the chemical plant area to the AEC in 1971 and the remainder of the property to the U.S. Department of Energy (DOE) in 1985. Prior to that transfer, the Army conducted building repair and additional decontamination activities in 1984. The DOE established a project office at the site in 1986 to support cleanup activities, and several interim response actions have been developed and implemented since that time.

The U.S. Environmental Protection Agency (EPA) listed the quarry on the National Priorities List (NPL) in 1987, and the chemical plant area was added to this listing in 1989. The balance of the former Weldon Spring Ordnance Works property, which is adjacent to the DOE portion of the property and for which the Army has responsibility, was added to the NPL as a separate listing in 1990.

A Record of Decision was prepared for management of the Weldon Spring quarry bulk wastes in 1990. The selected remedy entailed removal of the bulk wastes from the quarry, transportation along a dedicated haul road to the chemical plant area, and interim storage in the temporary storage area south of the raffinate pits. This work is presently underway.

## 3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

A Remedial Investigation/Feasibility Study (RI/FS) process was conducted for the Weldon Spring site in accordance with the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, to document the proposed management of the chemical plant area as an operable unit for overall site remediation and to support the comprehensive disposal options for the entire cleanup. Documents developed during the RI/FS process included the Remedial Investigation (DOE 1992b), a Baseline Assessment (BA) (DOE 1992c), a Feasibility Study (DOE 1992d), and a Proposed Plan (PP) (DOE 1992a). These documents incorporate values of the National Environmental Policy Act (NEPA), and they represent a level of analysis consistent with an Environmental Impact Statement (EIS). Together, the RI, BA, FS, and PP are the required primary documents consistent with the provisions of the First Amended Federal Facility Agreement entered into between the U.S. Department of Energy (DOE) and the

U.S. Environmental Protection Agency (EPA). In accordance with Section 117 of the CERCLA, copies of these final documents were released to the public on November 20, 1992. A public notice announcing the availability of these documents and the date for the public hearing was published in the St. Charles Journal on November 22, 1992.

The RI, BA, FS, and PP, along with other documents in the Administrative Record, have been made available for public review in the public reading room at the Weldon Spring site. Copies have also been made available to the public in information repositories at Francis Howell High School and at three branches of the St. Charles City/County Library: Kathryn M. Linneman, Spencer Creek, and Kisker Road. A notice of availability of these documents was published in the St. Charles Journal and the St. Charles Section of the St. Louis Post-Dispatch on November 22, 1992. An informational bulletin was also prepared to summarize this proposed action and facilitate the community participation process.

A public comment period for this remedial action was held from November 20, 1992, through February 19, 1993. A public hearing was held on December 16, 1992, at The Columns in St. Charles, Missouri, as part of the public participation process. This public hearing was advertised in the newspaper announcements listed above. At this meeting, representatives from the DOE and the EPA Region VII received comments from the public about the site and the remedial alternatives under consideration. Transcripts of the public meeting are included as part of the Administrative Record for this operable unit remedial action. The Administrative Record includes the information used to support the selected remedy. All public comments were considered in the decision-making process for determining the selected remedy.

A report of this hearing was featured in the site's publication, WSSRAP Update, copies of which were distributed to about 70,000 residences in St. Charles County on February 7, 1993.

A detailed response to the comments received during the public comment period for this remedial action was developed as a separate document and may be found in the Administrative Record and the information repositories. A responsiveness summary that addresses the major issues raised during the public comment period is attached to this Record of Decision. This decision document presents the selected remedial action for managing the chemical plant area of the Weldon Spring site in accordance with the CERCLA, as amended, and to the extent practicable, the National Contingency Plan (NCP). The decision for this site is based on the Administrative Record. 4 SCOPE AND ROLE OF REMEDIAL ACTION

This proposed remedial action is the major component of overall site cleanup (Figure 4-1), and addresses comprehensive disposal decisions for the project. The primary focus of this action is contaminated material at the chemical plant area, including that generated as a result of previous response actions. However, the scope also includes the disposition of material that may be generated by upcoming actions (e.g., at the Southeast Drainage and the quarry). Although cleanup decisions for other components of site remediation are not included in the scope of this action, the contaminated material that could be generated by future response actions is being considered to facilitate an integrated disposal decision. The types

of material that could result from future actions are the same as those being addressed in this action; i.e., soil, sediment, vegetation, and containerized process waste from the water treatment plants.

As used in this Record of Decision (ROD) and associated site documents, the use of the term "on site" refers to all areas, contaminated or otherwise, that exist within the physical boundaries of the Weldon Spring Chemical Plant (WSCP) and the Weldon Spring Quarry. The quarry and the chemical plant areas are reasonably close in proximity, and are compatible with regard to remediation approach. Therefore, they are considered one Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) site for purposes of this remedial action. "Off site" refers to those adjacent or nearby properties not located within the physical boundaries of the WSCP.

Several interim response actions have been selected for both the chemical plant area and the quarry and are currently being designed and/or implemented. The primary interim actions are summarized as follows:

- Excavation of solid wastes from the quarry, with transport to the chemical plant area for controlled storage in a temporary storage area (TSA) pending the disposal decision presented in this ROD.

- Removal and treatment of ponded water from the quarry, with transport of the treatment residuals to the chemical plant area for controlled storage as above.

- Removal and treatment of ponded water from surface water impoundments at the chemical plant area, with controlled storage of the treatment residuals as above.

- Consolidation and containerization of abandoned chemicals and process wastes.

- Decontamination and dismantlement of site structures, with controlled storage in the material staging area (MSA) and/or the TSA as above.

These removal actions have been (and are being) conducted to respond to contaminant releases and to mitigate health and safety threats in accordance with CERCLA requirements. The actions have also been conducted in accordance with Council on Environmental Quality regulations for implementing the procedural provisions of the National Environmental Policy Act (NEPA).

The role of this proposed remedial action is to establish appropriate responses and final conditions for solid material at the chemical plant area and to identify an appropriate disposal decision for waste generated by project cleanup activities. The action addresses management of the following materials to minimize potential releases and related exposures:

- Sludge, sediment and soil from the raffinate pits and ponds; site-wide soil (e.g., from past dump and spill areas); and soil and sediment from vicinity properties.
- ù Structural debris in storage at the MSA.

- Solid material excavated from the quarry - including soil, sediment, process residues, rock, building rubble and equipment, and vegetation - and in storage at the TSA.

- Containerized wastes, including residuals generated by the two water treatment plants and in storage at Building 434, the TSA, or other engineered facilities.

Cleanup decisions for sediment and soil in the Southeast Drainage, groundwater beneath the chemical plant area, and material remaining at the quarry following bulk waste removal (including groundwater) are not included in the scope of the current remedial action. Separate environmental documentation will be prepared within the next several years to support cleanup decisions for those locations and media. These documents will be developed in consultation with the U.S. Environmental Protection Agency (EPA) Region VII and the State of Missouri.

## 5 SITE CHARACTERISTICS

The site has been extensively studied to determine the nature and extent of contamination in various media. These studies have produced thousands of data records for soil, surface water, sludge, sediment, and building material and other debris. Groundwater has also been sampled, and limited biota sampling has been conducted. This information has been used to identify areas and media for cleanup. The results of these studies are presented in the Remedial Investigation for the Chemical Plant Area of the Weldon Spring Site (RI) (DOE 1992b). A general description of the environmental setting at the Weldon Spring site is presented in Section 1, including a discussion of key source areas and general contaminant information.

The primary source areas and key contaminants that have been identified at the site are summarized in Table 5-1. The estimated areas and volumesof contaminated media addressed by the disposal decision under this action are summarized in Table 5-2. The concentration ranges of the major radioactive and chemical contaminants at the site are listed in Tables 5-3 and 5-4. A discussion on background levels of these contaminants is presented in Section 2 of the Feasibility Study (FS) (DOE 1992d).

The RI information was used to assess human health and ecological risks for the site to determine if adverse effects could result from possible exposures. Site characteristics were evaluated for this assessment in order to identify the primary mechanisms of contaminant release and pathways by which site contaminants could be transported to potential receptors (humans and biota). The primary mechanisms and transport pathways identified for the site are:

- Surface runoff from on-site areas to off-site drainage soil and surface water.

- Surface water loss to groundwater via losing streams off site.

- Groundwater discharge to surface water via gaining streams off site.

- Leaching from contaminated surface and/or subsurface soil, sediment, or sludge to groundwater.

- External gamma radiation from radioactively contaminated surfaces, including building material and soil.

- Atmospheric dispersion of radon from radium-contaminated soil.

- Atmospheric dispersion of fugitive dust containing uranium, thorium, and radium.

In addition to areas of contamination on site, several off-site locations are contaminated as a result of releases that occurred during the operational period of the chemical plant (such as the release of raffinate pit surface water to the Southeast Drainage) in addition to ongoing releases (e.g., via surface runoff over contaminated soil and leaching of contaminants from the raffinate pits to groundwater). These off-site locations include Burgermeister Spring and three lakes in the Busch Conservation Area and 10 vicinity properties, one of which is the Southeast Drainage (which includes intermittent flow that is lost underground and reemerges downstream through a series of springs).

In order to develop specific cleanup decisions, a variety of information was used to estimate possible human health and ecological risks associated with the site. This information includes contaminant data from the extensive site characterization effort, fate and transport considerations, possible receptors, different types of exposures that could occur, and toxicological data developed by the U.S. Environmental Protection Agency (EPA) from the scientific literature. The risk estimates focus on the media and locations addressed by this remedial action. Section 6 discusses the receptors and routes of exposure, and also summarizes the risk assessment results.

Several key factors are relevant to the fate and transport of site contaminants and the potential for human and ecological exposures. First, certain interim actions at the site have not yet been completed - including dismantlement of all buildings and removal and treatment of water from the raffinate pits. (The latter is to be coordinated with raffinate sludge removal.) Therefore, although exposures to these areas are expected to be reduced within the next several years as these actions are implemented, related estimates (those health risk assessments performed for the building and raffinate-pit areas) were included in the Baseline Assessment (DOE 1992c) for the site. Second, surface water in the raffinate pits currently limits the emanation of radon, external gamma radiation and wind dispersion of the fine-grained sludge. If, in a future scenario, no site controls were in place and the surface water in the raffinate pits drained away (e.g., from a break in the dikes), air pathways could become an important exposure consideration for nearby individuals. Except in such a case, the air pathway does not play a role in contaminant transport because of the nature of surface features (including vegetation) and local meteorological conditions.

Local geology and geochemistry also play a role in contaminant transport. Solution features are present in the vicinity of the site, although the site

itself is not considered to be situated in an area of significant collapse potential. Site geology and surface water and groundwater flow were studied in coordination with the State of Missouri Department of Natural Resources, Division of Geology and Land Survey. This testing did not detect void space in the overburden or soil material, and voids in the limestone bedrock were few and small (with 90% of the void space within the upper 3 m [10 ft] of bedrock). No open subsurface networks were identified on site.

In addition, all surface water drainages on the chemical plant site are classified as gaining. Dye trace tests indicate that small voids do exist (e.g., in the weathered portion of the limestone bedrock), but results suggest that they are isolated. Thus, although contaminants that leach to groundwater (or are lost to the subsurface via nearby losing streams off site) could be further transported through solution channels rather than by diffuse flow, study results indicate that such transport at the site would be limited. In addition, clays in the overburden present low hydraulic conductivity and considerable attenuation capacity for contaminants that may leach from contaminated areas. (The site geology and flow characteristics continue to be evaluated in support of future documents and decisions for the groundwater operable unit. These documents will include an evaluation of potential exposure to groundwater.)

# 6 SUMMARY OF SITE RISKS

Potential human health effects associated with the chemical plant area of the Weldon Spring site and nearby off-site locations were assessed by estimating the radiological and chemical doses and associated health risks that could result from exposure to site contaminants. The assessment, which considered both current and future site conditions, is given in the Baseline Assessment for the Chemical Plant Area of the Weldon Spring Site (BA) (DOE 1992c) and in an updated rebaseline assessment in Appendix E of the Feasibility Study for the Chemical Plant Area of the Weldon Spring Site (FS) (DOE 1992d). Impacts to environmental resources are also addressed in the Baseline Assessment.

## 6.1 Contaminants of Concern

Radioactive and chemical contaminants and their concentrations in affected media are listed in Tables 5-3 and 5-4. The contaminants of concern for the human health assessment were identified from those detected in site soil, surface water, sediment, sludge, and buildings, and they represent the major chemical classes present at the site. These contaminants include radionuclides, metals, inorganic anions, nitroaromatic compounds, polycyclic (or polynuclear) aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and asbestos. Selection of the contaminants of concern was based on both the history of site operations and an evaluation of characterization data with respect to the distribution and concentration of contaminants in the various media at the site and the potential contribution of individual contaminants to overall health effects.

## 6.2 Exposure Assessment

### 6.2.1 Contaminant Fate and Transport

The fate and transport of contaminants released into the environment at the site were evaluated to determine potential exposure points. Human exposures evaluated were those resulting from potential contact with sources and affected media within the site boundary and contaminated media at off-site areas impacted by transport from the site.

The principal source areas and contaminated media identified at the site are (1) chemical plant buildings; (2) surface water and sludge at the four raffinate pits; (3) surface water and sediment at Frog Pond and Ash Pond (conservatively represented by the raffinate pits in this assessment because the contaminant levels are much higher in the pits); (4) contaminated soil at the north dump, at the south dump, at the coal storage area, around certain chemical plant buildings, and at other scattered locations; (5) groundwater in the upper aquifer in the Burlington-Keokuk Limestone; and (6) containerized chemicals in storage in Building 434.

Off-site locations and media that have been impacted by contaminant transport from these source areas include surface water and sediment in the Southeast Drainage (Weldon Spring Wildlife Area) and in Burgermeister Spring and Lakes 34, 35, and 36 (Busch Conservation Area). Soil at discrete areas, referred to as soil vicinity properties, is also contaminated as a result of past operations (Table 5-1).

The major pathways that have resulted in contaminant transport to these off-site locations are surface water runoff, surface water loss to groundwater (via losing streams), groundwater discharge to surface water (via gaining streams), and leaching from surface and/or subsurface material to groundwater. 6.2.2 Exposure Scenarios

To address the changing site configurations, five assessments were conducted for the chemical plant area that considered time, institutional controls, and land use. A sixth assessment was conducted for the off-site areas impacted by site releases. The receptors, areas and media contacted, and routes of exposure evaluated for these assessments are summarized in Tables 6-1 and 62 and are described as follows.

For the first assessment, the site configuration as of early 1992 was evaluated to identify potential health effects under baseline conditions. These conditions include the presence of the raffinate pits and buildings but not the temporary facilities such as the temporary storage area (TSA), material staging area (MSA), and water treatment plant that will be completed to support interim actions. About 200 workers are currently on site, and public access is controlled by a perimeter fence and security guards. The potential on-site receptors identified for these conditions are a site maintenance worker and a trespasser. A swimmer was also evaluated to address the possibility that an intruder might swim in the raffinate pits.

The same baseline site configuration was evaluated for the second assessment as for the first assessment, but it was hypothetically assumed that U.S. Department of Energy (DOE) and other workers were no longer at the site and access was no longer controlled. This assessment permits an evaluation of longterm impacts that might occur in the absence of any further

cleanup. Under these conditions, land use on site was assumed to be

recreational because the site is adjacent to two wildlife areas where recreational use is expected to continue into the reasonably foreseeable future. Consequently, a recreational visitor was identified as the future on -site receptor. To address possible exposures to contaminated game, a sportsman who was assumed to hunt on site was also evaluated. Because a sportsman might also fish at the off-site lakes, on-site and off-site exposures were combined for this receptor. Potential exposures were also assessed for an individual (youth) who was assumed to swim in the raffinate pits. The first and second assessments are presented in the BA (DOE 1992c).

For the third and fourth assessments, which are presented in Appendix E of the FS (DOE 1992d), the site configuration was assumed to reflect conditions associated with recent interim actions that are in various stages of planning and implementation. These actions include dismantling the chemical plant buildings and storing the material at the MSA, storing the bulk wastes excavated from the quarry at the TSA, and removing and treating water from the raffinate pits (Section 4). The purpose of these two assessments was to identify impacts that could occur if no further cleanup actions were taken at the site beyond those that have already been initiated, and assuming they are completed. These actions will result in interim or transitional site conditions because they represent only a partial completion of overall cleanup plans, pending implementation of the remedial actions identified in this Record of Decision (ROD).

Both short-term and long-term assessments were conducted for the interim site configuration. The short-term assessment evaluated possible health effects from the transitional site conditions for the reasonable scenario under which the DOE remains on site and existing institutional controls (e.g., access restrictions) are maintained; the maintenance worker and trespasser were the receptors evaluated. The long-term assessment of the interim site configuration evaluated exposures that could occur in the more extended future (e.g., after 100 years), hypothetically assuming that the DOE is no longer present and access to the site is unrestricted. Under these conditions, the most likely land use is recreational; therefore, the receptor evaluated was a recreational visitor.

The fifth assessment was conducted to focus the development of preliminary cleanup criteria for site soil. Soil is the only medium for which criteria were developed within the scope of the current remedial action because the other media have been addressed by interim actions. Therefore, a modified site configuration was evaluated by focusing on soil areas and not including the raffinate pits, buildings, and temporary facilities. For this assessment, which is presented in Appendix E of the FS (DOE 1992d), it was hypothetically assumed that the DOE is no longer present, that access is unrestricted, and that land use in the area might change in the extended long term (e.g., after 100 to 200 years and beyond). Four receptors were evaluated for this longterm assessment of the modified site configuration: a recreational visitor, a ranger, a resident, and a farmer.

For the sixth assessment, off-site exposures were evaluated for a member of the general public at Burgermeister Spring; Lakes 34, 35, and 36; the Southeast Drainage; and specific soil vicinity properties. Although most of these areas are located in the Weldon Spring and Busch conservation areas, several vicinity properties are located on the adjacent Army land to which

access is currently restricted. Recreational use of the conservation areas is expected to continue for the reasonably foreseeable future; hence, this assessment estimated exposures to the contaminated areas for a recreational visitor. (Ongoing and likely future exposures on the Army land would be bounded by those associated with recreational use because use of this land by Army personnel isless frequent. To be conservative, recreational use of those vicinity properties was evaluated for both the current and future assessments.) A swimmer was also evaluated for the off-site lakes.

Contaminant levels at the off-site locations are expected to remain the same or be somewhat lower in the future because interim actions are mitigating site releases. Therefore, one assessment was conducted for both current and future exposures that extend to 100 or 200 years and beyond. This assessment is presented in the BA (DOE 1992c).

Current data for the Southeast Drainage are limited, so exposures associated with this location will be reevaluated in greater detail within the next several years after more data become available. For the remaining vicinity properties, the results of the long-term assessment of the modified site configuration that considered nonrecreational land uses for on-site soil are incorporated into decisions for off-site soil. This addresses the possibility that local land use might change in the extended future.

### 6.2.3 Exposure Point Concentrations

Exposure point concentrations for the various media addressed in the exposure assessment were determined on the basis of data availability and the objective of the analysis. For the radioactive contaminants, not all contaminants of concern were directly measured. To address this issue, information from the radiological source term analysis for site soil and raffinate-pit sludge was used to infer concentrations of radionuclides was directly measured. Extensive data were available for soil, and contaminant heterogeneity was addressed by conducting both a site-wide and a location-specific analysis for all receptors except the farmer. For the site-wide analysis, the 95% upper confidence limit of the arithmetic average (UL[95]) value was used as the exposure point concentration for each contaminant. For the location-specificanalysis, actual measurements from each sample location were used as the exposure point concentrations. For the farmer analysis, the 4-ha (10-acre) Ash Pond area was the basis for exposure point concentrations. It was recognized that a larger area is required to support a family farm, and this area was chosen because it is the most radioactively contaminated and contains most of the chemical contaminants of concern. The farmer-area approach consisted of two methods: for chemical contaminants, the UL[95] of the arithmetic average from borehole measurements in the Ash Pond area was used; for radionuclides, the contour-weighted value was used. This value was determined using a statistical technique (kriging).

For the assessments evaluating current site conditions, exposure point concentrations for air were modeled from UL[95] values for the southern portion of the site, which is considered the most likely source of fugitive dust under baseline conditions. This modeling approach was used because measurements are not available for all airborne contaminants. Under future conditions, where the site configuration has changed, exposure point concentrations for the recreational visitor, ranger, and resident were

modeled from soil UL[95] values for the entire site. For the farmer, exposure point concentrations were modeled from soil concentrations consistent with the other pathways. For sludge, sediment, and surface water, maximum concentrations were used as the exposure point concentrations (with one exception), because screening-level analyses were conducted for these media and certain limitations exist for the available data. The exception is uranium in surface water at the Southeast Drainage, in which water flows intermittently and measured concentrations vary widely over time with runoff conditions; half the maximum measured concentration was used to represent this exposure point concentration over the 30-year exposure period.

For radioactive contamination in the buildings, averageconcentrations from Building 403, a former process building that is heavily contaminated, were used to represent exposure point concentrations for all buildings. The UL[95] value was used for residual PCB contamination from information for Building 408, and airborne concentrations of asbestos were determined from UL[95] values for Building 201. Cleanup decisions have already been made for buildings and surface water, so results of these conservative analyses are considered as screening-level information.

On the basis of the types of contaminants present at the site (i.e., most are relatively immobile and resistant to biodegradation) and the implementation of release controls to prevent further off-site releases, the contaminant levels at on-site and off-site areas are assumed to be similar to current conditions. Given that processing operations at the site ceased approximately 40 years ago, this is expected to be a reasonable but conservative assumption, with one exception. Ingrowth of Rn-222 from uranium would produce a peak concentration approximately 200,000 years in the future. This factor has been considered in the development of cleanup criteria. In general, other contaminant levels would be expected to decrease over time as a result of natural processes. Hence, the exposure point concentrations for the receptors evaluated under possible future site conditions were the same as those evaluated for current onsite receptors, and similarly, the exposure point concentrations for a future recreational visitor off site were assumed to be the same as those assessed for the current off-site recreational visitor. Because the exposure parameters for the off-site recreational visitor would also be the same under current and future conditions, only one assessment was conducted for this receptor.

## 6.3 Toxicity Assessment

Cancer and chemical toxicity are the two general health-effect end points from exposure to site contaminants. Cancer induction is the primaryhealth effect associated with radionuclides at the site, and 17 of the chemical contaminants of concern are classified as potential carcinogens. Four of the 17 are classified as Group A carcinogens (arsenic, chromium VI, nickel, and asbestos), for which strong evidence exists for human carcinogenicity.

A number of toxic effects are linked with exposure to noncarcinogenic contaminants. Uranium is the most significant contributor to noncarcinogenic health effects associated with site soil, and the chemical toxicity associated with human exposure to uranium is kidney damage. The PCBs inside the chemical plant buildings, and at a few soil locations, also

contribute significantly to potential chemical carcinogenicity and toxicity, which is characterized by skin effects and liver damage.

Potential carcinogenic risks from exposures to radiation were estimated using a two-phase evaluation. For the first phase, radiation doses were calculated for all relevant radionuclides and pathways using dose conversion factors (DCFs) based on dosimetry models developed by the International Commission on Radiation Protection. Radiological risks were calculated by multiplying the doses by a risk factor which represents an age-averaged lifetime excess cancer incidence per unit intake (and per unit external exposure). Three separate risk factors were used: (1) a risk factor of 3.5 x 10[-4]/working-level month (WLM) was used for inhalation of Rn-222 and its short-lived decay products; (2) a risk factor of 1.2 x 10[-4]/WLM was used for inhalation of Rn-220 and its short-lived decay products; and (3) a risk factor of 6 X 10[-7]/mrem was used for all other exposure routes.

The potential for carcinogenic and noncarcinogenic effects of human exposure to chemicals was quantified with slope factors and reference doses (RfDs). Cancer slope factors have been developed by the U.S. Environmental Protection Agency (EPA) for estimating incremental lifetime cancer risks associatedwith exposure to potentially carcinogenic chemicals. The slope factors, which are expressed in units of (mg/kg-d)[-1], are multiplied by the estimated intake of a carcinogen, in mg/kg-d, to provide an upper-bound estimate of the incremental lifetime cancer risk. These risk estimates are considered to be conservative because the slope factors are derived as upper -bound estimates such that the true risk to humans is not likely to exceed the risk estimate and, in fact, may be lower. Slope factors are derived from the results of human epidemiological studies or chronic animal bioassays. Slope factors derived on the basis of animal studies are adjusted to account for extrapolation from animals to humans.

Reference doses have been developed by the EPA for indicating the potential for adverse health effects from exposure to chemicals inducing noncarcinogenic effects. The RfDs, which are expressed in units of mg/kg-d, are estimates of the lifetime daily exposure level for humans, including sensitive subpopulations, that are likely to be without an appreciable risk of adverse effects during a lifetime. The potential for adverse health effects is
estimated by comparing contaminant intakes, in mg/kg-d, to the RfD. The RfDs are derived from the results of human epidemiological studies or animal studies, to which uncertainty factors have been applied. These uncertainty factors help ensure that the RfDs do not underestimate the potential for the occurrence of adverse noncarcinogenic effects.

The slope factors and RfDs are specific to the chemical, the route of exposure, and, for RfDs, the duration over which the exposure occurs. For all scenarios evaluated, the exposure duration exceeded a period of seven years; hence, chronic RfDs were applied to the assessment. The slope factors and RfDs used in the assessment are listed in Tables 6-3 and 6-4, respectively.

## 6.4 Summary of the Human Health Risk Characterization

Potential carcinogenic risks from radiological and chemicalexposures were

estimated for the human health assessment in terms of the increased probability that an exposed individual could develop cancer over the course of a lifetime. According to the NCP, an acceptable excess lifetime cancer risk to an individual from exposure to site contaminants is between 1 X 10[-4] to

1 X 10[-6] - or 1 in 10,000 to 1 in 1 million (EPA 1990). This range is referred to as the target risk range in this discussion, and it provides a point of reference for the site-specific risks presented in the BA and FS. To put this range in the context of the background cancer rate, about one in three Americans will develop cancer from all sources, and it is estimated that 60% of cancers are fatal (American Cancer Society 1992). These estimates translate to a fatality cancer risk of about 2 X 10[-1], or 1 in 5. The individual lifetime risk of fatal cancer associated with background radiation, primarily from naturally occurring radon, is estimated to be about 1 X 10[-2], or 1 in 100 (EPA 1989b).

Radiological risks were calculated by multiplying the estimated radiological doses by specific risk factors to estimate the probability of cancer induction per unit dose. Chemical risks were calculated by multiplying the estimated average daily intake by the chemical-specific slope factors.

The potential for adverse effects other than cancer from exposure to a single contaminant was assessed by estimating the hazard quotient - the ratio of the daily intake (averaged over the exposure period) to the RfD. The individual hazard quotients determined for each contaminant and medium to which a given receptor may be exposed were then summed to determine the hazard index; a hazard index of less than 1 was considered to indicate a nonhazardous situation. Conversely, if the total hazard index was greater than 1, apotential concern may be indicated.

To determine whether cleanup is warranted at NPL sites, the EPA considers incremental risks relative to the target range of 1 X 10[-6] to 1 X 10[-4], in combination with other site-specific factors (Appendix B). In the following summary of the risk results, estimates are presented as total risks unless otherwise specified. Potential incremental risks from exposures to site contaminants were assessed in developing cleanup criteria for site soil, which are discussed in Section 9 of this ROD.

The estimated risks and hazard indexes evaluated for exposures at the site under the baseline, interim, and modified future site configurations, as described in Section 6.2.2, are summarized in Tables 6-5 through 6-7. As appropriate to the site configuration and receptor, intakes and risks were estimated for exposures associated with (1) site-wide soil and air, (2) raffinate pit surface water and sludge, and (3) building air and residues. The significant findings of the risk assessment are summarized below and discussed with respect to their relationship to the need for remedial action; detailed discussions of the results of the risk characterization results are presented in the BA and in Section 1.6 and Appendix E of the FS.

For the baseline case, i.e., the current site configuration with continued access controls, the combined incremental risks from exposure to radioactive and chemical contaminants for the two hypothetical receptors evaluated - the maintenance worker and trespasser - exceed the upper end of the target

range; i.e., the risks are greater than 1 x 10[-4] (Table 6-5). Risks are also greater than the target range for the hypothetical recreational visitor under the modified (future) case, for which it is assumed, for purposes of analysis, that institutional controls are lost. The hazard index exceeds 1 for both the trespasser and recreational visitor. For the worker, inhalation ofradon (estimated from conservative assumptions for radium in site soil) accounts for most of this risk. For the trespasser and recreational visitor, the elevated risks are associated with exposures at the raffinate pits and buildings; the hazard index above 1 is associated with exposures at the buildings.

The reasonable maximum exposure (RME) for the raffinate pits and buildings would be incurred by the trespasser under current conditions and by the recreational visitor under hypothetical future conditions. The risks from exposures at the raffinate pits result primarily from exposure to radioactive contamination in the sludge; for the buildings, the risks are from combined exposures to radon, dust, and residues for the radioactive contaminants and from exposures to residues (PCBs) for the chemical contaminants.

Decisions have already been made for interim actions at the site to dismantle the buildings and remove surface water from the pits. For the buildings, that action will effectively remove all potential risks currently associated with indoor exposures. For the raffinate pits, removal of surface water under the interim action and excavation, treatment, and placement of raffinate pit sludge in the disposal cell under the current remedial action (see Section 9.1) will

eliminate the associated risks. Cleanup criteria have not been specifically developed for the waste sludge; rather criteria developed for site soil (as addressed in the following discussions and in Section 9.2) will be applied to determine the extent of excavation required at the pits.

The risks and hazard indexes estimated for the four future land-use scenarios under the modified site configuration are summarized in Table 6-7. These analyses focused on exposures related to soil contaminants (i.e., incidental ingestion of soil and inhalation of soil-generated airborne contaminants), and the results shown in the tables represent the range of values estimated from data for several hundred individual locations across the site, as discussed in Section 6.2.3. For the ranger, resident, and farmer, the estimated radiological risks exceed the target risk range at most locations, primarily from inhalation of radon. The estimated chemical risks and hazard indexes for the resident each exceed the target levels (1 x 10[-4] and 1, respectively) at 14 locations across the site. The potential noncarcinogenic effects are associated with incidental ingestion of soil, and the primary contributors are arsenic, PCBs, and uranium.

Future residential land use is considered to represent the RME scenario for the purpose of developing soil cleanup criteria protective of human health. Because the extent of exposure for a resident is greater than that associated with a worker (the RME scenario under current conditions), development of cleanup criteria on the basis of the more conservative residential scenario will also be protective of the worker. The development of cleanup criteria for site soil and the results of a "post-cleanup"

assessment of residual risks for RME and other scenarios are presented in Section 9.2.

For the off-site locations, exposures incurred by a recreational visitor represent the RME scenario. The hazard indexes for this receptor at these areas are less than 1, and the estimated risks are shown in Table 6-8. The radiological and chemical risks are less than 1 x 10[-5] at Burgermeister Spring and Lakes 34, 35, and 36, and hence fall within the target risk range. The radiological risks for the soil vicinity properties are also within or below the target risk range except for vicinity property B4 (Figure 6-1). The risk estimated for repeated exposures at this remote location in the Weldon Spring Wildlife Area (now referred to as the Conservation Area) is 3 x 10[-4]. The radiological risk estimated for similar exposures at the SoutheastDrainage is 2 x 10[-4], which also exceeds the target range.

Except for the Southeast Drainage, the DOE is planning to clean up all vicinity properties for which it has responsibility as part of the current remedial action. The same criteria developed for on-site soil (see Section 9.2) will be used for these areas. Specific cleanup decisions for the Southeast Drainage, which currently receives contaminated runoff from the site, are not included in the scope of the current remedial action (see Section 4); these will be addressed in separate environmental documentation prepared during the next several years to support final decisions for that area.

## 6.5 Ecological Assessment

The Weldon Spring site is located adjacent to two State conservation areas and more than 200 species of plants and animals are expected to occur on site. Several State-and Federal-listed threatened and endangered species have been identified in this area. Studies to date have not reported these species at the site, although the pied-billed grebe, a State rare species, has been observed at the raffinate pits. Soil contaminants at certain discrete locations that present a potential impact to exposed biota include arsenic, cadmium, copper, lead, zinc, mercury, uranium, and selenium. Possible effects reported in scientific literature include decreased biomass and diversity.

In off-site surface water, nitrate has been detected in the Southeast Drainage and Burgermeister Spring at levels that exceed water quality criteria. Thus, there is a potential for adverse impacts to off-site biota resulting from related exposure.

Certain contaminants in the raffinate-pit surface water exceed either water-quality criteria or concentrations reported in the scientific literature to adversely impact biota. For example, levels of beryllium, chromium, copper, lead, mercury, selenium, silver, uranium, and nitrate pose a potential hazard to aquatic and semiaquatic biota. Selenium is present at concentrations

exceeding those shown to adversely affect waterfowl. Furthermore, because selenium bioconcentrates, it could pose a hazard to wildlife species higher in the food chain.

Ecological impacts could occur to on-site and off-site biota if exposure to contaminants were to continue. Implementing the preferred alternative, or one of the other active measures considered, would minimize the potential for such impacts.

### 6.6 Conclusion

In summary, actual or threatened releases from this site, if not addressed by implementing the response action selected in this ROD, may present a threat to human health and the environment. Irretrievable and irreversible commitments of resources involved in this project are detailed in Section 10.6 of this document.

## 7 DESCRIPTION OF ALTERNATIVES

Alternative remedial actions for the site were developed as part of the Feasibility Study (FS) (DOE 1992d) by identifying remedial technologies and process options that are potentially applicable to the various contaminated media associated with the site. Potentially applicable technologies were incorporated into seven preliminary alternatives, and these alternatives were screened on the basis of effectiveness, implementability, and cost. From the screening analysis of the preliminary alternatives, the following final alternatives were retained for detailed evaluation:

- Alternative 1: No action.
- Alternative 6a: Removal, chemicalstabilization/solidification, and disposal on site.
- Alternative 7a: Removal, vitrification, and disposal on site.
- Alternative 7b: Removal, vitrification, and disposal at the Envirocare facility.
- Alternative 7c: Removal, vitrification, and disposal at the Hanford Reservation facility.

These alternatives are described in Sections 7.1 through 7.5 on the basis of preliminary conceptual engineering information. The no-action alternative was retained for this evaluation in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, and National Environmental Policy Act (NEPA) processes to provide a baseline for comparison with the final action alternatives.

The technology process options discussed herein (e.g., for chemical stabilization/solidification and vitrification) are considered representative of the general technologies that define the alternatives. The actual processes applied for site cleanup activities will be determined as part of the detailed design stage for this remedial action after the remedy is selected. Similarly, other representative components that have been evaluated for this analysis, such as the types of equipment and material and the treatment rates, will be specified as part of detailed design. The major regulatory requirements associated with each of these

alternatives are discussed within the subsection for each alternative.

## 7.1 Alternative 1: No Action

The National Contingency Plan (NCP) requires that the "no-action" alternative be evaluated at every site to establish a baseline for comparison. Under Alternative 1, no further action would be taken at the site. Certain interim response actions for which decisions have already been finalizedare assumed to be in effect, as follows: (1) the bulk waste excavated from the quarry would be in short-term storage at the temporary storage area (TSA); (2) the water treatment plants at the quarry and the chemical plant area would be operational; (3) the buildings and other structures would be dismantled, and the resulting material would be in short -term storage at the material staging area (MSA), debris staging area, and asbestos-container staging area; and (4) the containerized chemicals would remain in storage at Building 434. Contaminated soil, sludge, and sediment would remain in their current conditions, with continued potential for off-site releases during the short term and into the future. Site ownership, access restrictions, and monitoring would continue into the foreseeable future. Annual costs to maintain the site under this alternative are estimated to be approximately $1.2 million, with increases likely to address contamination that might be released in the absence of further source control or migration control measures.

Alternative 1 would not meet all applicable or relevant and appropriate requirements (ARARs).

## 7.2 Alternative 6a: Removal, Chemical Stabilization/Solidification and Disposal On Site

Under Alternative 6a, about 675,000 m[3] (883,000 yd[3]) of contaminated sludge, soil, sediment, structural material, vegetation, and process waste from the two water treatment plants would be removed from the source areas and on-site storage areas. Approximately 342,000 m[3] (447,000 yd[3]) of that material would be treated by chemical stabilization/solidification or volume reduction, as appropriate, and about 772,000 m[3] (1,010,000 yd[3]) of treated and untreated material would be placed in an engineered disposal facility on site.

It is expected that the remedial action activities could be completed within about 10 years after the Record of Decision (ROD) for this action. For this and all other alternatives, substantial, continuous, physical on-site remedial action could commence within 15 months after signature of the chemical plant ROD. Remedial actions could include removal of foundations and contaminated soils to cleanup levels; construction of retention/detention basins; or treatment of wastes currently stored in Building 434. A 15 month schedule would not be sufficient time in which to commence disposal cell construction, due to design and procurement requirements, nor could a treatment facility (for CSS or vitrification) be operational in this time frame, due to the necessity to perform additional treatment studies and pilot testing to implement full scale design and operation.

About one year would be required for pilot-scale testing; 3.5 to 4.5 years

for design, construction, and start-up of the chemical stabilization/solidification (CSS) process plant; and 4.5 years for operating the CSS facility. Construction and operation of the disposal facility would require about 6.5 years. (Some of these activities would overlap.) Groundwater, surface water, and air would be monitored at the site and at specific off-site areas throughout the cleanup and maintenance period to facilitate protection of the general public and the environment. Because waste would remain on site under this alternative (in the disposal facility), the U.S. Department of Energy (DOE) would review the effectiveness of the remedy at least every five years following the mitigation of the remedial action in accordance with the provisions of Section 121(c) of CERCLA, as amended.

Treatment would be used as a principal element of the response, primarily to reduce the mobility of contaminants in raffinate-pit sludge, process waste, and certain soils. Standard equipment and readily available resources would be used to implement Alternative 6a, and the total cost is estimated to be about $157 million. The representative technical components of this alternative are described in the following paragraphs.

Standard construction equipment and procedures would be used to remove contaminated sludge and soil from the raffinate pits; sediment from ponds and lakes; solid material (including structural material and debris, process equipment, rock, vegetation, and soil) from the MSA and TSA; underground pipes; and soil from dump areas, scattered locations across the site, and vicinity properties. Good engineering practices and other mitigative measures would be applied to minimize potential releases; for example, the size of the area being disturbed would be minimized and erodible material would be misted with water during excavation and transport.

Sludge would be removed from the raffinate pits with a floating dredge and then pumped as a slurry to an adjacent treatment facility. (Although much of the surface water in these pits would have been previously removed and treated under a separate action, a small amount of water would be left in the pits to cover the sludge and prevent radon and particulate emissions.) After the sludge had been removed, the more highly contaminated soil forming the berms and pit bottoms would be removed with conventional earth-moving equipment (such as bulldozers and front-end loaders) and transported by truck to the treatment facility. Similar equipment would be used to excavate sediment from other surface water impoundments after the water was removed and to excavate soil from across the site and vicinity properties. The excavated material not targeted for treatment would be transported by truck directly to the disposal facility.

Structural material, debris, and soil from the MSA and TSA would be removed and transported to the appropriate treatment facility or the disposal facility. In addition, a mobile chipper would be used intermittently to reduce the volume of woody material at the site; the resultant chips may be composted onsite to reduce the waste volume. Containerized process chemicals stored in Building 434 would be either transported off site to a permitted incinerator or treated in the on-site sludge processing facility with stabilization or by chemical neutralization.

Excavated areas would be backfilled with clean soil material, regraded to

natural contours matching the surrounding topography, and vegetated to support final site restoration. Much of the backfill could be obtained nearby; e.g., from a 81-ha (200-acre) parcel of land owned by the Missouri Department of Conservation located on State Route 94 across from Francis Howell High School. Additional fill such as gravel, sand, and topsoil may be obtained from local vendors.

Two new facilities would be constructed on site to support this alternative: one for CSS (the sludge processing facility) and another for physical treatment (the volume reduction facility). Each facility would be equipped with emission control systems to limit potential releases (e.g., a baghouse or high-efficiency particulate air [HEPA] filter system). A mulch pile would also be constructed on site to enhance the biodegradation of wooden debris and vegetation.

The volume of vegetation would be reduced and biodegradation facilitated by chipping vegetation in a mobile unit and then placing it in a composting facility (mulch pile) at the northern portion of the site. This pile would be maintained in an area of between 0.4 and 1.6 ha (1 and 4 acres) until material placement in the disposal cell could begin. The pile would be actively managed to enhance the biodegradation process, and this composting could result in a volume reduction of 80 to 90% (MKF and JEG 1992). The end product of the process would be placed in the on-site disposal cell. Materials such as railroad ties and utility poles would probably not be composted because they would have been treated with chemicals to inhibit biodegradation. These materials would be chipped and placed in the disposal cell.

The two criteria applied to determine what material will be treated by chemical stabilization/solidification are (1) whether treatment is needed to provide a structurally stable material, or (2) whether treatment is needed to eliminate the characteristic that would otherwise make the waste subject to the RCRA land disposal restrictions. Material expected to be treated includes the raffinate pit sludges (which are not structurally stable) and certain soil excavated from the quarry and in short-term storage at the TSA (which may be RCRA characteristic waste). Other material that may be treated includes process residuals from the water treatment plants and soil beneath the raffinate pits. Material treated by chemical stabilization/solidification would increase in volume by about 32%, and the overall volume for combined waste disposal would increase by about 12%. To minimize emissions during material transport to the sludge processing facility, the sludge would be pumped directly to the treatment facility as a slurry, and loose soil material would be wetted during transport over the short distances from the staging areas or pits.

The CSS treatment facility would be situated on approximately a 0.8 ha (2 acre) area located near the raffinate pits. Following dredging, settling, and thickening, the raffinate sludge would be conveyed to the CSS treatment plant by pumping or other continuous conveyance system. The thickened sludge would be placed in a storage tank and feed parameters (e.g., density and moisture content) checked before the sludge is metered into a mixing unit with binder agents. Binders that through bench scale testing have proven effective in immobilizing contaminants in the raffinate sludge and site and quarry soils are fly ash and Portland cement.

The CSS grout material resulting from the mixing of raffinate sludge and binder agents would be tested for quality control parameters and either betransported by truck to the disposal facility for grouting of voids in dismantlement debris or be further mixed with contaminated soils to produce a CSS soillike product. These quality control parameters will be determined during pilotscale testing of the CSS grout material. The batch material from the pilot scale program will be tested using the toxicity characteristic leaching procedure (TCLP). Results of TCLP testing will then be utilized to develop the quality control parameters for the grout material produced in the full-scale CSS facility. The mixing of CSS grout with soils would either be performed in the same mixer (e.g., high shear mixer) used to initially produce the CSS grout or, if necessary, another mixer (e.g., pug mill) which may be more suitable for producing a CSS soil-like material. This determination will be part of the CSS pilot testing program.

Other equipment components involved in the CSS treatment process such as tanks, pumps, compressors, valves, and piping for the preparation, storage, and conveyance of feed materials are readily available and widely used in the construction, mining, and hazardous waste remediation industries. The operating parameters of the CSS treatment facility will be refined and the CSS grout and soil-like formulas optimized to meet performance and placement criteria during pilot testing.

Volume reduction operations would include the use of materialsizing equipment such as a shear, an impact crusher, a rotary shear shredder, and an in-drum compactor to treat structural material, rock, and containerized debris such as used personal protective equipment. The volume of material processed by these methods would be reduced from 10% to 50%, depending on the specific material type. A decontamination unit would also be provided to treat selected structural materials for which release and reuse is practicable. Such material could be treated with a wet or dry abrasive blast process; the equipment and facility would contain emission control systems. Any structural material determined to be unreleased would be transported to the disposal facility.

Other facilities already present on site for interim actions would continue to be used for this remedial action, including the MSA, water treatment plant, and decontamination pad. Support facilities would also be maintained on site to provide electrical power, potable water, showers, portable sanitary facilities, offices for the construction management staff, and staging for excavation and construction activities. Most of these facilities are already in place, and they could be expanded to address incremental requirements associated with increased activity on site. Additional staging facilities would be constructed to support the heavy equipment needed for cleanup activities and to provide for stockpiling of material.

The various treatment and support facilities would be dismantled at the end of the remedial action period and either decontaminated for reuse (e.g., at another DOE facility) or, assuming reuse is not feasible or cost effective, treated by volume reduction and placed in the disposal facility. Following closure of the water treatment plant, a mobile water treatment unit may be utilized to support final site-closure activities.

An engineered disposal facility would be constructed at the chemical plant area within a specifically designated portion of the site that has undergone numerous subsurface investigations to confirm the suitability of the area for disposal of site wastes. The scope and range of the waste materials would cover an area of about 17 ha (42 acres) while the entire facility including the perimeter encapsulation dikes, would cover about 28 ha (70 acres). The design volume of material that would be placed in the cell is estimated to be about 1.1 million m[3] (1.5 million yd[3]). This value includes incremental swell factors associated with excavation and treatment, and a contingency ofabout 10% to address the potential contribution from subsurface and off-site material that has not yet been adequately characterized, including material that may be generated by future cleanup activities at the quarry and the Southeast Drainage.

The base of the disposal facility would consist of a double liner/leachate collection system. The lower leachate collection system would also serve as a leachate detection system and would facilitate the monitoring of cell performance during operation of the cell and the active leachate management period. The liners would be designed to minimize transport of any leachate from the contaminated material that would be contained in the cell. The multilayer cell cover would include an infiltration/radon attenuation barrier, a biointrusion layer, a frost protection layer, and an erosion protection layer. This cover would serve as a barrier to radon release and would protect against the potential effects of freeze-thaw cycles, intrusion by plant roots or burrowing animals, and erosion (including that associated with extreme precipitation events). The cell would be seismically engineered to withstand damage from potential earthquakes. The cell would be maintained and its performance would be monitored for the long term.

The cell would be constructed in stages to provide timely receiving capacity for waste generated by various concurrent cleanup activities (e.g., building dismantlement and volume reduction). This staged construction would minimize both the need for temporary storage and the potential for construction impacts by limiting the active work area. The cell would be maintained and its performance monitored for the long term, and its effectiveness would be reviewed every five years. The monitoring program would include visual inspection of the cell and regular testing of air, surface water, and groundwater. The surface water and groundwater monitoring program would comply with 40 CFR 264 Subpart F and 10 CSR 25-7.264(2)(f) as described in Section 10. This monitoring would be frequent (e.g., quarterly to annually) during the near term, and the frequency of monitoring would be evaluated within the five-year schedule, after the site entered long-term caretaker status and reduced, if appropriate.

Site-specific operational and contingency plans would be prepared to support the remedial action. These plans would specify (1) safe work practices, engineering controls, and worker protective equipment to reduce occupational exposures and/or contaminant releases; (2) monitoring techniques and frequencies; and (3) contingencies for a variety of possible occurrences (e.g., an accident, increased contaminant levels measured by monitoring systems, or an environmental disturbance such as a heavy rainstorm, tornado, or earthquake).

Under Alternative 6a, the DOE would continue to maintain custody of and accountability for the disposal area, but the remainder of the site could be released for other use. For example, the property outside the disposal location could be transferred back to the Army for incorporation into the adjacent Army Reserve Training Area, or it could be released for incorporation into the adjacent wildlife areas. Planning discussions would be held with parties interested in the future use of this property after the remedy is selected for the current remedial action. However, the final disposition of the site will not be determined until after the final remedy is selected for the chemical plant area; i.e., until after the decision is made for the groundwater operable unit within the next several years. Any institutional controls pertinent to the future use of this property, such as restrictions on the use of land or groundwater, would be identified at that time.

### 7.2.1 Applicable or Relevant and Appropriate Requirements

Federal and State environmental laws were evaluated for their applicability or relevance and appropriateness to the circumstances of the releases and threatened releases at the site. The applicable or relevant and appropriate requirements are discussed below.

Subtitle C of the Resource Conservation and Recovery Act (RCRA), as amended by the Federal Facilities Compliance Act (FFCA), regulates the generation, transportation, treatment, storage, and disposal of hazardous wastes as defined in 40 CFR 261. The determination on the applicability of RCRA Subtitle C requirements to the various response alternatives included an evaluation of whether any RCRA-listed or characteristic hazardous wastes were present at the site.

Based on current information (e.g., site records, the likely sources of contaminants), there are no known listed hazardous wastes present in any of the source areas on site. Three drums of containerized chemicals stored in Building 434 may be sufficiently similar to discarded commercial chemical products (listed wastes), which would make Subtitle C requirements relevant and appropriate to their management. However, it is not planned to manage these drums in the on-site treatment or disposal facilities. Further characterization of these drums is underway to assist in determining treatment/disposal options at a commercial facility. Pending a decision on treatment and disposal options for this waste, the drums are being stored on site in accordance with the RCRA.

A relatively small volume of materials fails the TCLP test and must be considered a characteristic hazardous waste. The management of these materials must comply with RCRA (as amended by the FFCA) Subtitle C requirements, until they are treated to remove the characteristics and successfully test to be nonhazardous. The analysis of action-specific ARARs addressing relevant and appropriate RCRA hazardous waste rules is presented in Section 10.

Past bench scale tests have shown that the chemical stabilization/solidification product will pass the TCLP test and that decant or free liquid fromthe product would very likely also pass. Ongoing studies are being conducted to confirm that the free liquid will pass the TCLP test.

This issue will also be addressed during CSS pilot scale testing. If needed, specialized addititives or reagents will be added to the CSS mixture to reduce any potential for the free liquid to fail the TCLP test. Although only small amounts of free liquid are expected to be generated from the CSS product, it will be managed through placement techniques as described in Section 10.2.3.4, Other Disposal Requirements.

All surface water discharges at the site are controlled through a surface water management program carried out in accordance with National Pollutant Discharge Elimination System (NPDES) permits issued under Section 402 of the Clean Water Act (CWA). Any changes in surface water discharges during construction of the disposal cell would be addressed through the NPDES permit.

The National Emission Standards for Hazardous Air Pollutants (NESHAP) are set forth under the Clean Air Act (CAA). The NESHAP standards have been set for those contaminants present in site wastes (i.e., radionuclides and asbestos) which may be released into the air during excavation/construction activities.

The following standards for radionuclides in 40 CFR 61 are applicable to remedial actions under consideration. Subpart H regulates emissions of radionuclides other than radon from DOE facilities. Emissions of these radionuclides to the ambient air shall not exceed amounts that would cause any member of the public to receive an effective dose equivalent of 10 mrem per year. Subpart H is applicable to the protection of the public during implementation of the remedial action as the Weldon Spring site is a DOE facility.

Subpart Q sets forth the standard for radon emissions. The standard states that no source at a DOE facility shall emit more than 20 pCi/m[2]s ofRn-222 into the air as an average for the entire source. This standard is applicable at completion of the final remedial action as the Weldon Spring site is a DOE facility.

Regulation 40 CFR 61 Subpart T is considered relevant and appropriate to final site conditions because the site contains material sufficiently similar to uranium mill tailings. Subpart T states that Rn-222 emissions to ambient air from uranium mill tailings piles which are no longer operational should not exceed 20 pCi/m[2]s.

The asbestos standard in 40 CFR 61 Subpart M requiring no visible emissions is considered to be applicable to some of the remedial actions under consideration. Various other requirements pertaining to asbestos abatement projects are promulgated in 40 CFR 61, Subpart M. These requirements address asbestos removal, demolition, and renovation operations. Because the Weldon Spring site remedial action includes asbestos abatement activities, these standards and requirements are applicable to the remedial alternatives under consideration. Removed asbestos is being stored on an interim basis pending final disposal. The NESHAP disposal requirements for asbestos are applicable at the time of final waste disposal.

Regulation 40 CFR 192.02(b), which addresses releases of radon from tailings disposal piles, is considered to be relevant and appropriate to those

aspects of the remedial alternatives which involve waste disposal. At completion, the disposal facility will have to meet the Rn-222 flux standards specified in 40 CFR 192.02(b). This standard requires reasonable assurance that Rn-222 from residual radioactive material will not (1) exceed an average release rate of 20 pCi/m[2]s, or (2) increase the annual average concentration of Rn222 in air at or above any location outside the site perimeter by more than 0.5 pCi/l. This regulation is relevant and appropriate as the Weldon Spring wasteis considered sufficiently similar to uranium mill tailings.

Subpart D of the Uranium Mill Tailings Remedial Action (UMTRA) regulations sets forth standards for the management of uranium by-product materials. Regulation 40 CFR 192.32(b) sets forth closure standards and is considered applicable to the remedial action at the Weldon Spring site, as the radioactively contaminated material has been classified as by-product material as defined in the Atomic Energy Act, as amended.

The State of Missouri has adopted the National Ambient Air Quality Standards (NAAQS) criteria specified in the CAA through the State Implementation Plan and has promulgated ambient concentration standards under 10 CSR 106.010. Implementation of some of the remedial alternatives could result in emissions of several of the criteria pollutants, including particulate matter (50 ug/m[3] annual average or 150 ug/m[3] over a 24-hour period) and lead (1.5 ug/m[3] quarterly average). Although ambient standards for these contaminants are not ARARs, the standards provide a sound technical basis for ensuring protection of public health and welfare during implementation and will be considered for components of the remedial action involving potential air releases.

Particulate standards promulgated under 10 CSR 10-5.180 (Missouri Air Pollution Control Regulations) for internal combustion engines (no release for more than 10 seconds at one time) are applicable to particulate release from any internal combustion engines used during implementation of the action.

The Missouri Department of Health has issued standards for Protection Against Ionizing Radiation in 19 CSR 20, which include a Rn-222 concentration limit of 1 pCi/L above background (quarterly average) in uncontrolled areas. This requirement is applicable to protection of the public during remedial action activities. The remaining requirements are similar to those identified in the DOE Orders for radiation protection of individuals and theenvironment, and the remedial action will also comply with the applicable provisions of those Orders.

Missouri has adopted by reference the RCRA Subtitle C hazardous waste management regulations. These State requirements are the same as the Federal requirements (the State requirements are not more stringent), which are considered ARARs. However, Missouri has also adopted additional rules, which include landfill siting requirements, that are considered legally applicable to the disposal of hazardous waste in the State. These requirements are discussed separately, with the action-specific ARARs identified in Section 10.

Atomic Energy Act (AEA) requirements for DOE's radioactive waste management

and radiation exposure standards are incorporated into DOE Orders developed under DOE's AEA authority. These Orders are generally consistent with, and typically include, equivalent technical Nuclear Regulatory Commission (NRC) requirements that are appropriate for DOE operations and waste management. DOE Order requirements are "to-be-considered" (TBC) requirements, which when included in a DOE CERCLA Record of Decision (ROD) are enforceable cleanup standards under the CERCLA. Limited sections of NRC requirements can be "Relevant and Appropriate" or TBC only when DOE Orders do not clearly address a specific condition or particulars of the site, and supplemental requirements from NRC requirements are needed to facilitate protection of human health and the environment.

Key environmental requirements promulgated by the NRC were assessed to determine their potential as relevant and appropriate or to-be-considered (TBC) requirements for the Weldon Spring Site Remedial Action Project. Radiation exposure standards are promulgated in 10 CFR 20. These standards are not applicable because they apply only to NRC licensees. Neither are these standards both relevant and appropriate based on the circumstances of the action relative to the type of facility for which similar, equallyprotective standards have been established in DOE Orders 5400.5, Radiation Protection of the Public and the Environment; and 5480.11, Radiation Protection for Occupational Workers, for radiation protection. The remedial action will be conducted in accordance with DOE Order 5400.5, Chapter II, "Requirements for Radiation Protection of the Public and the Environment" and Chapter III, "Derived Concentration Guides for Air and Water." The remedial action will also follow DOE Order 5480.11.

Standards published under 10 CFR 61 address the disposal of lowlevel radioactive waste. These requirements are not applicable because the definition of wastes covered under this part specifically excludes 11e(2) byproduct materials. Neither are the requirements of 10 CFR 61 both relevant and appropriate because the design standards address near-surface disposal, for which the disposal unit is typically a trench, and release for unrestricted use could be considered after 500 years on the basis of assumed radioactive decay and migration. These requirements are not technically appropriate to the long-lived, radon-generating, alpha-emitting materials present at the Weldon spring site. The remedial action will be conducted in accordance with DOE Order 5820.2A, Radioactive Waste Management, Chapter III, "Management of Low-Level Waste" and Chapter IV, "Management of Waste Containing Byproduct Material and Naturally Occurring and Accelerator Produced Radioactive Material."

### 7.3 Alternative 7a: Removal, Vitrification, and Disposal On Site

Alternative 7a is similar to Alternative 6a except that vitrification would be the treatment method for the sludge, the more highly contaminated soil and sediment, and the containerized process waste. Under Alternative 7a, about 675,000 m[3] (883,000 yd[3]) of contaminated sludge, soil, sediment, structural material, and water treatment plant process wastes would be removed from the source areas and on-site storage areas. About 342,000 m[3] (447,000 yd[3]) of that material would be treated by vitrification or volume reduction, as appropriate, and about 522,000 m[3] (683,000 yd[3]) of treated and untreated material would be placed in an engineered disposal facility on site.

It is projected that remedial action activities could be completed in 10 years following the ROD, if no difficulties were encountered during testing, start-up, or operation. It is estimated that 2.5 to three years are estimated to be required for bench-scale and pilot-scale testing; five to seven years for design, construction, and start-up of the vitrification facility; and four years for operation. As construction and operation of the disposal facility would require about 6.5 years, some of these activities could overlap. However, the total time required for these activities could be longer because of the innovative nature of this technology. As in Alternative 6a, releases would be controlled with good engineering practices and mitigative measures, and monitoring would be conducted throughout the cleanup and maintenance period to address protection of the general public and the environment. Similarly, the DOE would review the effectiveness of the remedy every 5 years.

Treatment would be a principal element of Alternative 7a, and vitrification would reduce the toxicity of certain contaminants (e.g., nitrate and nitroaromatic compounds); the toxicity of radiation from the site waste would not be affected by vitrification (or any other treatment method). Vitrification would also reduce the mobility of contaminants in soil and sludge and the disposal volumes of these media; this treatment method would result in a volume reduction of about 68% for the treated material and an overall volume reduction of 24% for the combined waste. The volume of other material, such as structural debris and vegetation, would be reduced as described for Alternative 6a.

Standard equipment and readily available resources would be used for the excavation and nonthermal treatment operations. However, equipment and resources are not readily available for vitrification. Use of the vitrification technology for large-scale operations is innovative and would require further bench-scale and pilot-scale testing followed by engineering scaleup before implementation at the Weldon Spring site. The total cost of implementing Alternative 7a is estimated to be about $182 million. The representative technical components of removal and much of the treatment and disposal components are the same as described for Alternative 6a. Those components of Alternative 7a that differ from Alternative 6a are described in the following paragraphs.

The vitrification unit within the sludge processing facility would be expected to consist of two melters operating in parallel to provide system flexibility. The contaminated material that would be treated in these melters is the same material that would be chemically treated under Alternative 6a. Feed preparation (sludge dewatering and material sizing) would be required before vitrification. In addition, the sludge and soil would have to be mixed in an optimized blend ratio to produce a glassy product. The vitrification process would operate continuously (24 hours per day throughout the year), and would consume a considerable amount of energy.

The vitrified product would be irregularly shaped 0.32- to 0.64-cm (1/8- to 1/4-in.) pieces of glass-like fritted material; it would be collected in a hopper and transferred to bins for truck transport directly to the disposal facility or to an adjacent staging area. Emissions from the vitrification process would be treated before release to the atmosphere. The specific off

-gas treatment system would be developed following bench-scale and pilot-scale testing and optimization, but it would likely consist of a heat removal system, a primary quench scrubber, a submicron aerosol scrubber, a nitrogen oxide gas removal system, and a final filtration system, as required. Offgas treatment requirements under this alternative would result in additional technical complexity, and delays could occur if inadequate controls were achieved during testing.

The location of the disposal area would be similar to that identified for Alternative 6a. However, for Alternative 7a, it was assumed that two cells could be constructed over the same general surface area. The first would be the same as that described for Alternative 6a, only smaller, and would receive all but the vitrified material. The design volume for nonvitrified material is about 591,000 m[3] (773,000 yd[3]) with contingency. This disposal facility would cover about 12 ha (30 acres). A second cell could be constructed for the vitrified material, and it could have less stringent engineering controls if pilot testing demonstrated that the product would resist leaching. That is, although this cell would contain a cap similar to that described for Alternative 6a and a compacted natural clay liner, it would not include a leachate collection system because the material is expected to withstand leaching into the long term. The design volume of this cell is about 86,400 m[3] (113,000 yd[3]) with contingency, and it would cover an area of about 5 ha (12 acres). The vitrified material would be cohesionless and would be placed in the cell in alternate layers with a binder such as clay to promote waste compaction and increase cell stability. The cell would be maintained and its performance monitored for the long term. As described for Alternative 6a, site-specific operational and contingency plans would be prepared to support the remedial action phase of this project, and institutional controls would be maintained for the long term.

On the basis of continuing engineering evaluations and pending further analyses to be developed during the detailed design phase, this approach might be modified to parallel the scenario described under Alternative 6a. The result would be a single disposal facility, designed to contain both the vitrified and untreated waste, which would incorporate the same features described under Alternative 6a. The major difference would be the smaller size of the cell because of volume reduction achieved during vitrification. The analyses for the representative case in the FS are expected to bound potential impacts that would be associated with cell operations (including construction, waste placement, and closure) under the modified approach if Alternative 7a were selected.

### 7.3.1 Applicable or Relevant and Appropriate Requirements

ARARs for this alternative are similar to the ones discussed for Alternative 6a. Additional emission standards for Alternative 7a are discussed below.

Regulation 40 CFR 266, Subpart H provides RCRA emissions standards for hazardous waste burned in boilers and industrial furnaces. This requirement is considered applicable to the vitrification alternative, as the fossil-fuel heated melter proposed for the vitrification facility is an industrial furnace that will process hazardous wastes. Part 266.104 states that the furnace must achieve a destruction and removal efficiency of 99.99% for each

principal organic hazardous constituent. Concentrations of carbon monoxide (CO) in the off-gas must not exceed 100 ppmv (parts per million by volume) over a 60 minute moving average. Particulate emissions must not exceed 180 mg/dscm (dry standard cubic meter) or 0.008 gr/dscf (dry standard cubic foot) when corrected to 7% oxygen in the stack gas. In addition, Part 266.102 states that CO, oxygen, and possibly total hydrocarbons must be monitored continuously at a point downstream of the combustion zone and prior to release into the atmosphere. The monitoring must conform with performance specifications found in Appendix IX of 40 CFR 266.

Regulation 10 CSR 10-5.030 limits particulate matter emissions fromnew indirect heating sources. Regulation 10 CSR 10-5.050 limits particulate matter from any industrial source to less than 0.030 grain/standard ft[3] of exhaust gas. Regulation 10 CSR 10-5.090 limits the opacity of the exit gas to 20%. The regulations are considered applicable to the vitrification process as the fossil-fuel heated melter is considered an industrial furnace which emits exit gases.

7.4 Alternative 7b: Removal, Vitrification, and Disposal at the Envirocare Facility

Alternative 7b is similar to Alternative 7a except that the treated and untreated material would be transported to the Envirocare facility near Clive, Utah, for disposal. It is expected that the removal and treatment activities at the Weldon Spring site could be completed within the same time frame as Alternative 7a; however, the environmental compliance process associated with obtaining the necessary license to dispose of the large volume of by-product material at the Envirocare facility could delay implementation of this alternative. Release controls and monitoring would also be the same as previously described. Under this alternative, the same material targeted for treatment under Alternative 7a would be vitrified at the Weldon Spring site before off-site transport for disposal. The total cost of implementing Alternative 7b is estimated to be about $351 million.

The Weldon Spring waste is classified as 11e(2) by-product material as defined in the Atomic Energy Act, as amended. The DOE can transfer this type of material only to organizations licensed to receive it by the U.S. Nuclear Regulatory Commission (NRC). This requirement would apply to the disposal of waste from the Weldon Spring site at the Envirocare site. The Envirocare site has been permitted by the State of Utah to accept mixed hazardous waste and naturally occurring radioactive material. However, a disposalfacility is not currently available at the site to receive material from the Weldon Spring site (i.e., 11e(2) by-product material). Envirocare of Utah, Inc., has submitted an application to the NRC for a license to allow for disposal of 11e(2) by-product material, and the NRC is currently preparing an Environmental Impact Statement (EIS) to support the license application. Because of the nature of the regulatory compliance process associated with the proposed Envirocare facility, the Weldon Spring site cleanup might be delayed for several years under this alternative, depending on the length of time it takes the NRC and the Envirocare owners to complete the environmental review process.

The technologies and activities that would be used to construct, operate, and maintain a disposal facility for the Weldon Spring waste at the

Envirocare site would most likely be similar to those identified for Alternative 7a. Although implementation of Alternative 7b would allow for release of the entire Weldon Spring site for future uses, the site will be evaluated every five years to evaluate the effectiveness of the cleanup. The long-term institutional controls appropriate for the Weldon Spring site would be determined on the basis of final site conditions, which will depend on the remedy selected for the groundwater operable unit, as described for Alternative 6a.

To support off-site disposal, the treatment facilities planned for the Weldon Spring site would have to be modified to include a staging area for loading the waste product into containers and onto trucks for off-site transport. These trucks would then transport contaminated material from the Weldon Spring site to a rail siding transfer station in Wentzville, Missouri, that would be either leased or newly constructed to support this action. About 38,600 trips would be required to transport the material to the siding over a combined one-way haul distance of 932,000 truck-km (579,000 truck-mi). The material would then be transferred to railcars for subsequent shipment along a commercialrail line to Clive, Utah. The transportation component of this alternative would probably extend over seven years. On the basis of an estimated 515 required train trips, Alternative 7b would involve transportation over about 1,240,000 rail-km (773,000 rail-mi).

Transport of waste for off-site disposal at the Envirocare facility would result in an increased risk of transportation accidents, with the potential for exposing workers and the general public to radioactive and chemically hazardous substances. On the basis of current statistics for highway and rail accident rates and the distance that would be traveled by transport vehicles, a total of about six transportation accidents would be expected to occur. About half of these would be truck accidents, largely as a result of truck transport of the waste to the rail siding transfer station in Wentzville. The remaining three transportation accidents would involve railcars transporting the waste to Clive. Based on statistics, no fatalities would be expected, although several injuries could occur as a result of these accidents.

### 7.4.1 Applicable or Relevant and Appropriate Requirements

Compliance with ARARs under Alternative 7b would be the same as for Alternative 7a. In addition, applicable requirements for transportation of radioactive and chemically hazardous material to the Envirocare facility would be met.

## 7.5 Alternative 7c: Removal, Vitrification, and Disposal at the Hanford Reservation Facility

Alternative 7c is similar to Alternative 7b except that the contaminated material would be transported to the Hanford Reservation facility near Richland, Washington, for disposal. Removal and treatment considerations would be the same as described for Alternative 7b, and the basic components of off-site disposal would be similar.

Under Alternative 7c, cleanup activities at the Weldon Spring site could be

delayed many years because an appropriate disposal facility is not currently available at the Hanford facility to receive site waste and no such facility is planned. The technologies and activities that would be used to construct, operate, and maintain a disposal facility at the Hanford site would likely be similar to those identified for Alternative 7a. The total cost of implementing Alternative 7c is estimated to be about $304 million. This cost is based on an estimate of $130/m[3] ($100/yd[3]) to dispose of the large volume of waste from the Weldon Spring site. The cost estimate for this alternative assumes that long-term monitoring and maintenance at the Hanford site would cost the same as at the Weldon Spring site. A detailed cost analysis would be performed to develop a firm price for disposal at the Hanford site, if this were a component of the remedy selected for the Weldon Spring site.

Transport of contaminated material to the Hanford site for disposal would involve the same considerations identified for Alternative 7b, but Alternative 7c would require transporting the material along a commercial rail line to Richland, Washington, and transferring it to a dedicated rail line for transport to the Hanford site. On the basis of an estimated 515 train trips, Alternative 7c would involve transportation over about 1.7 million rail-km (1.1 million rail-mi) during an estimated seven-year period. A total of about eight transportation accidents would be expected, three involving trucks and five involving railcars. (More railcar accidents are expected for Alternative 7c than 7b because of the longer transport distance.) Statistically, no fatalities would be expected, although several injuries could occur as a result of these accidents.

### 7.5.1 Applicable or Relevant and Appropriate Requirements

Compliance with ARARs under Alternative 7c would be the same as for Alternative 7a. In addition, applicable requirements for transportation of radioactive and chemically hazardous material to the Hanford Reservation facility would be met.

## 8 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The U.S. Environmental Protection Agency (EPA) has identified nine evaluation criteria against which final remedial action alternatives are to be evaluated. These criteria are derived from statutory requirements in Section 121 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, as well as other additional technical and policy considerations that have proven to be important for selecting remedial alternatives. A balancing of these criteria is used to determine the most appropriate solution for the specific problems at each site. These statutory mandates, which any selected remedy must meet, include protection of human health and the environment, compliance with applicable or relevant and appropriate requirements (ARARs), cost effectiveness and use of a permanent solution and alternate treatment or resource recovery technologies to the maximum extent practicable. The nine criteria are:

1. Overall protection of human health and the environment. Addresses protection from unacceptable risks in both the short term and the long term by minimizing exposures.

2. Compliance with ARARs. Addresses compliance with Federal and State environmental requirements and State facility siting requirements, unless a waiver condition applies.

3. Long-term effectiveness and permanence. Addresses residual risks, focusing on the magnitude and nature of risks associated with untreated waste and/or treatment residuals. This criterion includes a consideration of the adequacy and reliability of any associated institutional or engineering controls, such as monitoring and maintenance requirements. 4. Reduction of contaminant toxicity, mobility, or volume through treatment. Addresses the degree to which treatment is used to address the principal hazards of the site; the amount of material treated; the magnitude, significance, and irreversibility of specific reductions; and the nature and quantity of treatment residuals.

5. Short-term effectiveness. Addresses the effect of implementing the alternative relative to potential risks to the general public during the action period, potential impacts to workers and the environment during the action period, the effectiveness and reliability of mitigative measures, and the time required to achieve protection of workers and the environment.

6. Implementability. Addresses technical feasibility, including the availability and reliability of required resources (such as specific material and equipment, facility capacities, and availability of skilled workers); the ease of implementation; and the ability to monitor effectiveness. This criterion also addresses administrative feasibility, e.g., coordination with other agencies and the need for approvals or permits for off-site actions as appropriate to the alternative.

7. Cost. Addresses both capital costs and operation and maintenance costs, as well as the combined net present worth.

8. State acceptance. Addresses formal comments made by the State of Missouri on the consideration of alternatives and identification of the preferred alternative.

9. Community acceptance. Addresses the formal comments made by the community on the alternatives under consideration.

The first two criteria are considered threshold criteria and must be met by the final remedial action alternatives for a site (unless a waiver condition applies to the second criterion). The next five criteria are considered primary balancing criteria and are evaluated together to identify the advantages and disadvantages in terms of effectiveness and cost among the alternatives. The last two are considered modifying criteria and are evaluated after the Remedial Investigation/Feasibility Study (RI/FS) has been reviewed.

8.1 Threshold Criteria

8.1.1 Overall Protection of Human Health and the Environment

All of the final alternatives except Alternative 1 (no action) would provide overall protection for human health and the environment. This protection

could not be ensured for the extended future, if no action were taken, because over time contaminants could migrate via groundwater to off-site receptors, resulting in possible impacts. For each of the action alternatives, human and environmental exposures would be reduced by removing the sources of contamination, treating the waste that contributes to the principal hazards at the site, and managing low-risk contaminated materials not requiring treatment by permanently containing these untreated materials with the treated waste product in an engineered disposal facility designed to prevent the release of contaminants into the environment for at least 200 to 1,000 years.

8.1.2 Compliance with ARARs

Alternative 1 (no action) would not comply with all Federal and State ARARs.

Alternative 6a would meet all location, action, and contaminantspecific ARARs with the exceptions of:

- The State of Missouri's Rn-222 limit of 1 pCi/1 above background in uncontrolled areas (19 CSR 20-10.040) may not be achieved during implementation: Absolute compliance with requirement during all phases of remedy implementation is technically impracticable from an engineering perspective (Section 121(d)(4)(C) of the CERCLA).

- Regulation 40 CFR 61, Subpart M presents NationalEmission Standards for Hazardous Air Pollutants (NESHAP) requirements for asbestos handling. Due to technical impracticability and potential increased exposure to personnel, the small pieces of asbestos found in the quarry bulk wastes (smaller than 0.6 m x 0.6 m x 0.05 m [2 ft x 2 ft x 2 in.]) will not be segregated from the soils. As this material is moved from the temporary storage area (TSA), the NESHAPs requirements will be waived under Section 121(d)(4)(B) of the CERCLA.

- Regulation 40 CFR 268, Subpart E specifies the land disposal restrictions (LDRs). The LDRs prohibit the storage of restricted wastes unless storage is solely for the purpose of accumulating sufficient quantities of wastes to facilitate proper treatment, recovery, or disposal. The limitations on storage time are waived under Section 121(d)(4)(C) of the CERCLA.

- Regulation 40 CFR 268, Subpart C specifies LDR restrictions on hazardous waste placement. This requirement is waived under Section 121(d)(4)(A) of the CERCLA.

- Regulation 40 CFR 268, Subpart D specifies treatment standards which must be attained prior to land disposal of the hazardous waste. The treatment standard based upon use of a specified technology is waived under Section 121(d)(4)(D) of the CERCLA.

- Regulation 10 CSR 25.5-262(2)(C)1 sets forth the State regulation that hazardous wastes stored prior to off-site shipment shall comply with U.S. Department of Transportation (DOT) regulations regarding packaging, marking, and labeling. Meeting new packaging requirements for storage set forth in the DOT requirement HM-181 (in 49 CFR) could

potentially result in unnecessary personnel exposure. Therefore, this requirement is waived under Section 121(d)(4)(A) andSection 121(d)(4)(B) of the CERCLA.

- Regulation 40 CFR 761.65(a) requires that any polychlorinated biphenyl (PCB) article or container be removed from storage and disposed of within one year from the date when it was first placed in storage. This requirement is waived under Section 121(d)(4)(A) of the CERCLA.

- Regulation 40 CFR 761.75(b)(3) of the Toxic Substance Control Act (TSCA) states that the bottom landfill liner system or natural in-place soil barrier shall be at least 17 m (50 ft) from the historical high-water table. This requirement is waived under Section 121(d)(4)(D) of the CERCLA.

- Regulation 40 CFR 264.314(f) sets forth restrictions on the placement of waste containing free liquids in a landfill. This requirement is waived in accordance with Section 121(d)(4)(B) and Section 121(d)(4)(D) of the CERCLA.

Alternative 7a would meet all location, action, and contaminantspecific ARARs.

The exceptions to this alternative meeting all ARARs, and waivers for these exceptions, are the same as those discussed under Alternative 6a. The waiver for 40 CFR 264.314(a), (b), (c), and (d) regarding placement of free liquids in a landfill is not applicable to Alternative 7a, as vitrification produces a glass-like product with no liquids.

Compliance with location, contaminant, and on-site action-specific requirements for Alternative 7b would be similar to that described for Alternative 7a. Applicable requirements for transportation of radioactive and chemically hazardous material to the Envirocare facility would be met under this alternative.

Compliance with ARARs under Alternative 7c would be similar to thatdescribed for Alternative 7b.

## 8.2 Primary Balancing Criteria

### 8.2.1 Long-Term Effectiveness and Permanence

The long-term effectiveness of chemical stabilization/solidification generally is considered to be less than for vitrification (i.e., wastes that are vitrified could be expected to resist leaching for a longer time [thousands of years] compared with the chemically stabilized form [hundreds of years]. However, the uncertainties with regard to the performance and implementability of vitrification steered the decision toward a more demonstrated technology. In fact, it was this combination of performance uncertainty and potential for greater long-term effectiveness that led to the decision to further evaluate vitrification as a contingency treatment option in the selected remedy. The important point is that residual risks at the site would be reduced to near background levels regardless of which technology is used. The required monitoring and five-year reviews will

provide an effective precaution against any future potential release going undetected and resulting in actual exposure. In addition, long-term effectiveness and permanence of the disposal facility is affected by the loss of institutional controls. The likelihood that institutional controls would be lost is the same for Alternatives 6a and 7a. However, continuation of institutional controls into the extended long term at a commercial facility (Alternative 7b) might be more difficult to ensure than at a Federally owned facility (Alternatives 6a, 7a, and 7c).

8.2.2 Reduction in Toxicity, Mobility, and Volume through Treatment

Greater reduction in toxicity, mobility, or volume through treatment would be achieved for Alternatives 7a, 7b, and 7c (vitrification), as compared with Alternative 6a, chemical stabilization/solidification (CSS). The volume of structural material, vegetation, and wooden debris would be similarly reduced under each alternative; however, for the sludge and soil that would be treated by vitrification, some contaminants (e.g., the limited organic compounds) would be destroyed, the others would be immobilized in a glass-like matrix, and the overall disposal volume would decrease by about 24%. Alternative 6a would also significantly reduce contaminant mobility by incorporating contaminants into a cement-like matrix, but contaminant toxicity would not change and the overall waste disposal volume would increase by about 12%.

8.2.3 Short-Term Effectiveness

The short-term effectiveness of Alternatives 6a and 7a would be essentially the same. Potential short-term impact concerns from the implementation of Alternative 7b or 7c would be substantially greater than for Alternative 6a or 7a, due to the increased handling of waste material and the transportation of the waste to the off-site locations.

The two key differences among the final action alternatives are the treatment method and the disposal location (which includes a transportation component for the off-site disposal alternatives). Therefore, impacts to workers and the general public from removal activities during the remedial action period would be similar for each alternative because the same areas would be excavated or dredged. Incremental impacts to workers and the public from treatment activities could result from differences between the chemical treatment and vitrification operations, i.e., additional emissions are associated with vitrification, as compared with CSS, because contaminants would be released from the stack of the vitrification facility. However, these emissions are expected to be controlled by an extensive air pollution control system within the facility, so related impacts would be small to none.

Potential health impacts for members of the general public during the cleanup period would be below the EPA target limits for protecting human health for each of the action alternatives. Impacts would be relatively higher for Alternatives 7b and 7c than for Alternative 6a or 7a because of the increased likelihood of exposures and accidents during the waste handling and transportation activities for off-site disposal. The potential for risk to workers would be higher under the vitrification alternatives because this process would require more workers and additional accidents

could result from the hazards of high operating temperatures and limited field experience.

Environmental impacts could potentially result from excavating and dredging contaminated material, constructing access roads, staging areas, and other support facilities; constructing and operating the disposal facility (either on site or off site); and excavating borrow soil from a location near the Weldon Spring site to provide backfill for the remediated areas on site and to construct the cell under Alternatives 6a and 7a. Additional impacts could be associated with activities at the rail siding in Wentzville and other transportation operations under Alternatives 7b and 7c. Except for the permanent loss of habitat at the disposal facility area and possibly at the off-site borrow location (depending on the location selected during detailed design), any potential impact would be short term and likely could be mitigated by various standard practices, e.g., engineering controls to limit erosion and siltation. A mitigation action plan will be developed that will outline specific measures to be implemented for environmental controls or to address contingency response actions.

### 8.2.4 Implementability

The implementation of Alternative 6a would be the most straightforward of the final action alternatives because the chemical stabilization/solidification technology has been utilized at other sites and would use readily available resources. Implementation of chemical stabilization/solidification at the Weldon Spring site (testing, design, construction, and start-up) is estimated to require a maximum of five years. Implementation of Alternative 7a, 7b, or 7c would require further engineering scale-up of the vitrification system and application of that innovative technology to a large waste volume. Although the results of bench-scale testing have shown that the Weldon Spring wastes can be successfully vitrified, they also indicate the need for further testing to evaluate treatment of waste materials representing the extremes in chemical variability, and to test treatment equipment that would be similar in type and function to that required in full-scale operations. Implementation of vitrification at the Weldon Spring site (testing, design, construction, and start-up) is estimated to require about 7 years. However, there is greater uncertainty with this estimate due to the innovative nature of the technology. Alternative 7b or 7c would require coordination of licensing, regulatory compliance, and establishment of administrative procedures (as appropriate) in order to dispose of the Weldon Spring waste at either off-site facility.

Difficulty in implementing either Alternative 7b or 7c would include such factors as permitting of the facilities and transportation of the wastes to the off-site facilities. While the Envirocare facility is permitted to accept mixed hazardous waste and naturally occurring radioactive material, there is no permitted disposal facility currently on the site that may receive 11e(2) by-product material. Envirocare has submitted an application to the NRC for a license to dispose of 11e(2) by-product material. The Hanford facility (Alternative 7c) does not currently have an appropriate disposal facility to receive Weldon Spring site waste. Construction of such a disposal facility at Hanford could delay cleanup activities at the Weldon Spring site for several years. Transportation concerns include constructing

the necessary rail siding transfer station in Wentzville, Missouri, and the increased risk of transportation accidents.

8.2.5 Cost

| Description of Alternatives | Approximate Costs (in millions) |
|---|---|
| Alternative 1: No Action | $1.2 (annual) |
| Alternative 6a: Removal, Chemical Stabilization/Solidification, and Disposal On Site | $157 (total) |
| Alternative 7a: Removal, Vitrification, and Disposal On Site | $182 (total) |
| Alternative 7b: Removal, Vitrification, and Disposal at Envirocare Site near Clive, Utah | $351 (total) |
| Alternative 7c: Removal, Vitrification, and Disposal at the Hanford Reservation Site near Richland, Washington | $304 (total) |

8.3 Modifying Criteria

8.3.1 State Acceptance

The State of Missouri has requested that the DOE agree to certain stipulations as a condition for obtaining State concurrence. These stipulations are:

- No wastes from other sites shall be disposed of at the Weldon Spring site.
- An on-site disposal facility shall meet the substantive siting and design requirements of State and Federal hazardous waste laws and regulations.
- The selected remedial alternative shall be protective of human health and the environment.
- Cleanup procedures, design, and standards shall meet all State and Federal ARARs.
- Human radiation exposures must be reduced to a level that is as low as reasonably achievable (ALARA).
- The DOE shall commit to cleaning up the contaminated vicinity properties. These properties include several small locations on the adjacent Army area, August A. Busch Conservation Area, and Weldon Spring Conservation Area.

- Natural barriers and engineered materials, methods, and designs shall be used to the maximum extent possible in order to achieve a protective and permanent waste disposal solution, and institutional control measures shall be minimized.

- The U.S. Department of Energy (DOE) shall retain ownership and control of the disposal facility.

- The DOE shall commit to long-term monitoring and maintenance of the disposal facility.

### 8.3.2 Community Acceptance

In general, the comments received from the public indicate acceptance of Alternative 6a as a selected remedy for the Weldon Spring site. The main concerns that were raised involved a commitment by the DOE that the on-site disposal facility be used solely for Weldon Spring wastes, and that no off-site wastes be accepted for disposal on site. There were also concerns for safeguards to the Francis Howell High School population.

As stated in this Record of Decision (ROD), no off-site wastes will be accepted for disposal at the Weldon Spring site. In addition, measures taken to facilitate the safety of personnel at Francis Howell High School have been described in the Remedial Investigation/Feasibility Study-Final Environmental Impact Statement (RI/FS-Final EIS) package.

## 9 SELECTED REMEDY

On the basis of the evaluation of final alternatives, Alternative 6a (removal, chemical stabilization/solidification, and disposal on site) has been identified as the selected remedy for remedial action at the chemical plant area of the Weldon Spring site. The key components of the remedy are described in Section 9.1, and the cleanup criteria developed for this remedy are presented in Section 9.2.

### 9.1 Key Components

Material will be removed from contaminated areas, treated as appropriate by chemical stabilization/solidification, and disposed of in an engineered disposal facility constructed on site (Figure 9-1). The treatment method specified in the selected remedy will substantially reduce the risks associated with those waste materials that represent the principal hazard at the site. This remedy will also provide for the safe management of less contaminated site wastes. This alternative will reduce risks and provide protection of human health and the environment in less time and at a lower cost than the other action alternatives. Chemical stabilization/solidification is an established technology that uses readily available resources and has been utilized at other sites, and disposal in an on-site engineered facility would also use readily available resources and standard technologies.

Chemical stabilization/solidification will be the treatment method used for contaminated sludge, certain quarry soil and sediment, and certain other

contaminated soil from the site (such as soil taken from beneath the raffinate pits). Material treated by chemical stabilization/solidification will undergo an increase in volume of about 32%. Volume reduction operations will be used to treat structural material, rock, and containerized debris (e.g., used personal protective equipment). The average volume of material processed by these methods will be reduced by between 10% and 50% depending upon the specific material type. Volume reduction operations will include a decontamination unit that can be used to treat selected structural materials for which release and reuse is practicable.

An engineered disposal facility will be constructed in the area of the chemical plant within a specifically designated portion of the site that has undergone numerous subsurface investigations to confirm the suitability of the area for disposal of site waste. The design volume of material that would be placed in the cell is estimated to be about 1.1 million m[3] (1.5 million yd[3]). The base of the disposal facility will be designed to minimize the downward

transport of any leachate from the contaminated material that will be contained in the cell. The long-term multilayer cell cover will serve as a barrier to infiltration and radon release and will protect against the potential effects of freeze-thaw cycles, intrusion by plant roots or burrowing animals, and erosion (including that associated with extreme precipitation events). In addition, the cell will be seismically engineered to withstand damage from potential earthquakes. The disposal facility will be maintained and its performance will be monitored for the long term.

Table 9-1 presents the estimated costs of the selected remedy. These costs are based on preliminary conceptual design information. Some changes may be made to the remedy as a result of the remedial design and construction processes. Such changes reflect modifications resulting from the engineering design process and could increase the cost estimates identified in this table.

Vitrification of the contaminated sludge, soil, and sediment (instead of chemical stabilization/solidification) is being retained as a contingency treatment option. Vitrification is being carried forward into theconceptual design phase so the effectiveness of this technology and the uncertainties associated with its implementability can continue to be evaluated. Estimated costs for this contingency remedy (Alternative 7a) are presented in Table 9-2.

If it becomes necessary to implement the contingency treatment option (vitrification and disposal on site) because chemical stabilization/solidification does not perform adequately during pilot-scale testing (i.e., if engineering limitations prevent treatment of the waste or if it is not possible to consistently produce a waste product which passes the toxicity characteristic leaching procedure [TCLP] test), an Explanation of Significant Differences from the selected action in this ROD will be developed in accordance with U.S. Environmental Protection Agency (EPA) guidance for post-ROD changes and this document will be made available to the public.

Since both chemical stabilization/solidification and vitrification processes involve the addition of soils, a practical approach is to use site soils with higher levels of radioactivity, such as those from Ash Pond and the north dump. These soils will be mixed preferentially with raffinate sludge and quarry bulk waste. If additional soil mixing material is needed, other site soils with still lower concentrations of radioactivity will be used preferentially over uncontaminated borrow soils.

## 9.2 Cleanup Criteria

Interim actions have addressed cleanup criteria for surface water at the Weldon Spring site, and groundwater will be addressed as a separate operable unit in the future. Thus, soil is the focus of cleanup criteria for the current remedial action (as discussed in Section 2 of the FS). Cleanup criteria for the key contaminants in site soil were developed from available environmental regulations and guidelines in combination with the results of the site-specific risk assessments. As part of the latter, a site-specific analysis was conducted to address the reduction of residual risks to levels as low as reasonably achievable (ALARA), as described in Section 2 of the FS. For the purpose of developing these criteria from risk information, the RME was identified as the residential scenario described in Section 6.2.2, under which exposures to soil were evaluated for inhalation and incidental ingestion combined. In accordance with the NCP, the initial point of departure for the development of the cleanup criteria was an incremental risk level of 1 x 10[-6] for carcinogens. A hazard index of 1 was the target for the noncarcinogens. However, for many of the contaminants at the Weldon Spring site, the point of departure for incremental risks could not reasonably serve as the endpoint for site cleanup criteria. That is, background concentrations of certain naturally occurring metals (including the radionuclides present at the site) correspond to risks more than 100 to 1,000 times greater than this level. Thus, it is very difficult to distinguish incremental contamination from variability in background concentrations that correspond to a fractional increment of 1 x 10[-6]. For this reason, the site-specific risk assessments addressed reducing residual risks to ALARA levels, as described in Section 2 of the FS.

The soil areas identified for remediation on the basis of the riskbased criteria determined from these assessments are shown in Figure 9-2. Concentration-based criteria were also developed for each primary contaminant of concern to provide a means for ensuring that cleanup has been achieved, i.e., by verification sampling across the site. These criteria are listed in Tables 9-3 and 9-4 and represent the total concentrations (i.e., including background) above which site soil would be removed; the ALARA goals represent lower levels that the remedial action would aim to achieve during fieldexcavation activities.

If soils with contaminant concentrations exceeding natural background are released off site, further risk assessments must be performed using parameters specific to the intended use or disposition of the soils. Concrete rubble will be treated like soil and will likewise not be released off site. The criteria contained in DOE Order 5400.5 will be used for materials (such

as metal scrap) with solid exterior surfaces. These criteria are compatible

with standards used throughout the nuclear industry.

### 9.2.1 Radioactive Contaminants

Cleanup criteria for the radionuclides of concern at the Weldon Spring site - i.e., Ra-226, Ra-228, Th-230, Th-232, and U-238 - were determined from available standards and guidelines in combination with risk assessment information. These cleanup criteria address all radionuclides that may be present at the site, using results of a site-specific radionuclide source term analysis. The procedures used to develop these criteria are described in Section 2.2 and Section 2.4 of the FS. The criteria for Ra-226 and Ra-228 were adopted from EPA standards given in 40 CFR 192 that were determined to be relevant and appropriate to the conditions at the Weldon Spring site (see Section 10.2). Cleanup criteria for Th-230 and Th-232, which were adopted from DOE Order 5400.5, were included to protect from future exposures to Ra-226 and Ra-228 (and Rn-222 and Rn-220) as a result of radionuclide ingrowth. If both Th-230 and Ra-226, or both Th-232 and Ra-228, are present and not in secular equilibrium, the cleanup criteria apply for the radionuclide with the higherconcentration. At locations where both Ra-226 and Ra-228 are present, the cleanup criteria of 5 pCi/g (above background) in the top 15 cm (6 in.) of soil, and 15 pCi/g (above background) in each 15-cm (6-in.) layer of soil more than 15 cm (6 in.) below the surface, applies to the sum of the concentrations of these two radionuclides. For U-238, no general standards are available. Hence, the cleanup criterion was developed on the basis of the site-specific risk assessment alone; this criterion is 120 pCi/g.

In accordance with the both the CERCLA process and DOE Order 5400.5, results of the site-specific risk assessment were then applied to determine the ALARA goals for each radionuclide. The ALARA goal represents the level that can reasonably be achieved during field implementation within existing constraints, as indicated by site-specific conditions. As discussed in Section 2 of the FS, the constraints for developing ALARA goals for radionuclides at the Weldon Spring site are the ability to measure the contaminants in the field, distinguish contamination from background, and verify that cleanup has been achieved. The ALARA goals for Ra-226, Ra-228, Th-230, and Th-232 at all depths are each 5 pCi/g, including background. As described above for the cleanup criteria, the ALARA goal for the radium isotopes applies to the sum of the concentrations of Ra-226 and Ra-228 at locations where both contaminants are present. For surface soil, the ALARA goal is 5 pCi/g combined, including background; for subsurface soil, the ALARA goal is 5 pCi/g combined, above background. The ALARA goal for U-238 at all depths is 30 pCi/g, including background.

### 9.2.2 Chemical Contaminants

The chemical contaminants of concern for which final cleanup criteria were developed are arsenic, chromium, lead, thallium, PAHs, PCBs, and TNT. Some ARAR and TBC information is available for lead and PCBs, and these standards and guidelines were used as the starting point to develop cleanup criteria, in combination with the site-specific risk assessments. For lead, the EPA has established interim guidance that considers the natural presence of lead in soil and recommends a cleanup level of 500 to 1000 mg/kg, as determined by site-specific conditions (EPA 1989a). The EPA has also developed an

uptake/biokinetic model to estimate blood lead levels in children, who represent the most sensitive subpopulation for the residential scenario. The health-based criterion developed for lead on the basis of site-specific input to this model is 450 mg/kg.

For PCBs, regulations in the Toxic Substances Control Act that address cleanup of soil following a spill of PCB-contaminated material were considered relevant and appropriate to site conditions (see Section 10.2). The standard indicates that soil in areas of unrestricted access at which a spill occurs should be decontaminated to 10 mg/kg by weight, and this served as the starting point of the analysis. A health-based criterion of 8 mg/kg was determined on the basis of the risk assessment and other site-specific considerations, as discussed in Section 2.4.2.6 of the FS. ARARs are not currently available for the remaining chemical contaminants, so the cleanup criteria were developed solely on the basis of the site-specific risk assessments.

Cleanup criteria were developed for those contaminants at the Weldon Spring site that contribute significantly to site risks or hazard indexes on the basis of contaminant levels measured during extensive site characterization activities. Several nitroaromatic compounds - DNB, 2,4-DNT, 2,6-DNT, NB, TNB, and TNT - have been detected in site soil at a few discrete locations, but the results of the site-specific risk assessments indicate that the concentrations of these compounds are below levels of concern, except for TNT. For this reason, a final criterion has been developed only for TNT. For the remaining nitroaromatic compounds, the preliminary target levels presented in Section 2.5 of the FS will serve as the starting point for addressing these contaminants, if detected during field activities at levels higher than those currently identified in site characterization activities. Sampling during and after soil remediation will be conducted to ensure that residual risks associated with these compounds do not exceed the target range and that the hazard indexes are below 1 (see Section 4 of the Proposed Plan and Section 9.2.3 of this ROD).

Soil contamination at the Weldon Spring site is heterogeneous, i.e., contaminants are located in different combinations at different areas of the site. For the chemical contaminants, the areas that will be excavated were identified on the basis of actual measurements from the locationspecific assessment and the results of the risk assessment (Figure 9-2). This risk-based approach allows the identification of areas for remediation resulting from the presence of multiple contaminants.

The concentration-based cleanup criteria were also developed from the site-specific risk assessment, considering information on the known patterns of contamination (Table 9-4). In general, the chemical contaminants contributing significantly to health effects near or above target levels are not present together; hence, additivity was generally not an issue in developing the cleanup criteria. The few areas at which multiple contaminants are present were identified for remediation on the basis of the location-specific risk assessment. However, to address the possibility that additional contaminant co-location may be found during field activities, lower ALARA goals were also established for all chemical contaminants. As indicated above, remediation of site soil will be designed to meet these ALARA goals. For lead, PAHs, PCBs, and TNT, the ALARA goals are the levels

that had been proposed for statewide consideration by the Missouri Department of Health (1992) for soil in residential settings; the levels were withdrawn subsequent to the preparation of the FS. Many of these health-based levels were consistent with the ALARA process, so they have been retained. However, the draft State levels for arsenic and thallium were considerably below local background concentrations, and the levels for chromium were higher than those derived from the site-specific assessment. Hence, the draft State levels (subsequently withdrawn) were not adopted as ALARA goals for those three contaminants.

It is expected that contaminant levels remaining in soil across the site after remediation will range between the cleanup criteria and the ALARA goals, reaching the goals in most cases. Excavating soil to achieve these levels is expected to reduce risks to within or below the target risk range and to reduce hazard indexes below 1. Even lower criteria will be applied on a location-specific basis, if areas are identified during field work at which multiple contaminants are present. These criteria will be determined by combining the appropriate information from the target risk tables in Section 2.5 of the FS to ensure that health-protective concentrations have been achieved.

The cleanup criteria for chemical contaminants in subsurface soil at the site were addressed by separate analyses to ensure that levels remaining would be protective under future scenarios that could involve exposure to contaminants that are currently buried. For the purpose of site cleanup, subsurface is defined as soil deeper than 15 cm (6 in.) below the surface. As discussed in Section 2.4.2 of the FS, the lower potential for exposures to subsurface material compared with surface material - i.e., from redistribution of this soil on the surface and leaching of contaminants to groundwater resulted in the selection of subsurface criteria for chemicals that are 10 times the surface criteria. In no case will the subsurface residual levels exceed the subsurface cleanup criteria. The ALARA goals for subsurface soil are the same as the cleanup criteria for surface soil, averaged over a 3 m (10 ft) depth. The plans for site remediation will be designed to achieve subsurface ALARA goals. Thus, based on the known patterns and locations of contamination, subsurface cleanup is expected to attain the subsurface ALARA goals.

### 9.2.3 Post-Cleanup Assessment

Excavating soil to meet the cleanup targets for chemicals at the site would result in an incremental chemical risk at or below the EPA's target range for all scenarios, and the hazard index would be well below the level of concern. However, this is not the case for the radiological cleanup criteria, because incremental radiological risks exceed the target range at certain locations under a residential scenario. (The radiological risk at an uncontaminated area is about 3 x 10[-3], which indicates the difficulty in distinguishing an incremental risk of 1 X 10[-4] from contamination versus natural variability.) Therefore, an additional "post-cleanup" assessment was conducted for the radionuclides. For this assessment, areas with soil concentrations that exceed the ALARA goals were assumed to be excavated and backfilled with uncontaminated soil from a nearby background area. The results of this evaluation were also used to assess compliance with environmental standards and guidelines.

Results indicate that the incremental radiological risk across the site for the resident, following soil excavation and backfill would range from 0 (i.e., background) to 6 x 10[-3], with a median of 8 x 10[-6]. Locations where the risk would exceed 1 x 10[-4] are generally those areas where the radium concentration in soil slightly exceeds the background concentration of 1.2 pCi/g; a small increment of 0.075 pCi/g corresponds to a risk of 1 x 10[-4]. (This highlights the issue associated with meeting the EPA's target.) In addition, an annual dose of 25 mrem/yr above background could not be achieved for residential use at about 10% of the soil areas. The elevated risk estimates

for those areas result almost entirely from exposures to the estimated levels of indoor radon, which would be generated by the residual radium in soil (entering through the basement or foundation slab). However, the target risk range was not specifically developed on the basis of exposures to radionuclides, and the EPA has separately identified an acceptable level for indoor radon of 4 pCi/L (EPA 1992a). The indoor radon concentrations associated with the cleanup target and goal for radium are expected to be at or below this level at all site locations.

For outdoor air, the incremental radon concentration is estimated to be less than 0.1 pCi/L, and the annual dose from inhalation of airborne particulates generated from site soil is estimated to be less than 10 mrem/yr at all locations. Hence, standards for the radiological dose from exposure to outdoor air would be met by the cleanup targets for site soil. Potential leaching to groundwater, for radionuclides from soil, was also assessed for post-remedial action conditions to provide an initial indication of the potential impact to future receptors, in the event that groundwater in the shallow aquifer at the site was used for drinking. The results indicate that the proposed cleanup targets for soil are expected to be protective of groundwater. (This pathway will be evaluated further in the upcoming, final assessment of the chemical plant area.)

The incremental risk estimated for the ranger from sitewide exposures following remediation varies from 2 x 10[-5] to 2 x 10[-4], with a median of 2 x 10[-5]. The median and low end of the range are the same, because outdoor exposures from site-wide activities dominate the combined risk from indoor and outdoor exposures for this hypothetical receptor at most locations. For the recreational visitor, the incremental risk is estimated to be 7 x 10[-6]. Thus, the incremental radiological risks associated with future recreational land use at the site are within the target range.

Following completion of site cleanup activities, an assessment of the residual risks based on actual site conditions, including measured concentrations of site contaminants, will be performed to determine the need for any future land use restrictions. This assessment will consider the presence of the on-site disposal cell, the buffer zone, the adjacent Army site, and any other relevant factors necessary to ensure that appropriate measures are taken to protect human health and the environment for the long term. The remedy selected in this ROD will be re-examined at least every five years to ensure that it is protective.

## 10 STATUTORY DETERMINATIONS

In accordance with the statutory requirements of Section 121 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, remedial actions shall be selected that:

- Are protective of human health and the environment.
- Comply with applicable or relevant and appropriate requirements (ARARs).
- Are cost effective.
- Utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.
- Satisfy the preference for treatment which, as a principle element, reduces toxicity, mobility, or volume.

The manner in which the Weldon Spring Chemical Plant remedial action satisfies these five requirements is discussed in the following sections.

## 10.1 Protection of Human Health and the Environment

The selected remedy is protective of human health and the environment by (1) removing the sources of contamination, (2) treating the materials giving rise to the principal threats at the site to reduce contaminant mobility, and (3) containing treated and untreated materials in an engineered disposal facility designed to prevent migration of contaminants into the environment. The contingency remedy would also be protective of human health and the environment for the same reasons, with additional protection provided by treating contaminated materials to reduce toxicity and volume.

## 10.2 Compliance with Applicable or Relevant and Appropriate Requirements

Both the selected remedy and the contingency remedy will comply with ARARs, unless those requirements have been properly waived in accordance with CERCLA, and will be performed in accordance with all pertinent U.S. Department of Energy (DOE) Orders. The ARARs are presented below according to locationspecific, contaminant-specific, and action-specific requirements. Removal, treatment, transportation, and disposal of the contaminated material for both the selected remedy and the contingency remedy are on-site actions and must comply with the substantive requirements of Federal and State environmental laws that are ARARs.

ARAR waivers that are appropriate to this action are discussed in the following sections.

### 10.2.1 Location-Specific ARARs

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in a specific location. The analysis of location-specific ARARs included a review of the Resource Conservation and Recovery Act (RCRA), the Missouri Hazardous Waste Management Laws, the Antiquities Act, the Historic Sites

Act, the National Historic Preservation Act, the Archeological and Historic Preservation Act, the Archeological Resources Protection Act, the Endangered Species Act, the Missouri Wildlife Code, the Fish and Wildlife Coordination Act, the Clean Water Act (CWA), and the Farmland Protection Policy Act.

Federal Executive Order 11988 and Missouri Governor's Executive Order 82-19 require that adverse impacts associated with activities in a floodplain be avoided to the maximum extent practicable. These requirements are considered applicable to the Weldon Spring remedial action. It is noted, however, that a portion of the Schote Creek 100-year floodplain extends onto the site in an area where excavation of contaminated soil is planned. The excavation of these materials will not increase the potential for off-site transport due to flooding; in fact, these remedial actions will result in the removal of these materials from within the 100-year floodplain.

No long-term impacts to flood storage capacity are anticipated from the remediation of the Ash Pond drainage and vicinity property A6. Potential short-term impacts, resulting primarily from vegetation clearing and excavation activities, would be mitigated by using good engineering practices and implementing the following mitigative measures: (1) erosion and sediment control measures, such as berms and silt fences, will be used during all excavation, fill, and contouring activities; contaminated soil and sediment will be excavated only when the Ash Pond drainage channel is dry; only clean fill will be used; excavated areas will be filled as soon as practicable after excavation and graded to original contours as much as possible; and revegetation activities will be implemented as soon as possible following recontouring of the refilled areas.

Executive Order 11990 requires Federal agencies to avoid, to the extent possible, any adverse impacts to wetland areas. This order is considered applicable since there are several areas on site (such as the pits) that are considered wetlands. There is no practicable alternative but to remove the contaminated material from these areas. The potential off-site soil borrow are also contains wetlands. Mitigative measures are being coordinated with the State of Missouri and will be defined in the mitigation action plan. A Clean Water Act Section 404 permit will be obtained from the U.S. Army Corps of Engineers due to activities that may impact the wetland at the borrow area.

The DOE has initiated consultations with the U.S. Fish and Wildlife Service (FWS) regarding the need for mitigation of the on-site wetlands that would be lost as a result of remedial activities at the site. The FWS has recommended that the DOE consider wetland creation as a means of mitigating the wetlands loss. The DOE has initiated surveys of wetlands that could be affected by site activities to document their size, type, and biotic composition. Upon completion of these surveys and additional consultations with the FWS and the Missouri Department of Conservation, the DOE will develop a wetlands mitigation plan for the site that is expected to include wetlands creation. Mitigative measures will be taken at the off-site borrow area, such as contouring to ensure that downgradient wetlands are not indirectly impacted.

The Farmland Protection Policy Act (7 CFR 658; 40 CFR 6.302[c]) requires Federal agencies to assess the adverse impacts of Federal programs on

farmland preservation and to consider alternative actions to lessen the adverse effects. This requirement is considered applicable for the potential offsite soil borrow area, as the borrow area has been classified as prime or unique farmland. A separate environmental assessment is planned for the borrow area to assess possible environmental impacts. Mitigation measures and restoration activities would be conducted at the off-site borrow area, as necessary, to minimize any adverse impacts to farmland.

Because the potential soil borrow area is off site, the requirements, including administrative requirements, of the following acts are applicable: the Archaeological and Historic Preservation Act, the Archaeological Resources Protection Act, and Section 404 of the Clean Water Act. TheArchaeological and Historic Preservation Act requires that data recovery and preservation activities be conducted if prehistoric, historical, and archaeological data might be destroyed as a result of a Federal activity. A permit is required for excavation or removal of any archaeological resources on Federal lands under the Archaeological Resources Protection Act. Studies are being performed to determine if any archaeological sites or resources will be affected in the borrow area, and whether any resources would be removed before soil is excavated. A permit would be obtained for removal of any archaeological resources in the borrow area.

Location standards are specified under RCRA (40 CFR 264.18) that address the siting of new hazardous waste treatment, storage, and disposal facilities. These requirements are considered to be applicable to the siting of the treatment facility (chemical stabilization/solidification or vitrification), since the unit is expected to treat hazardous wastes. However, the treatment process will render the characteristic wastes nonhazardous; therefore, these standards are not applicable to the disposal facility. No listed wastes will be managed in the treatment system or the disposal facility. Certain of these requirements, as well as the companion requirements in the Missouri Hazardous Waste Management Laws, may be relevant and appropriate to the disposal facility as described below:

- Regulation 40 CFR 264.18(a) restricts locating hazardous waste management facilities within 200 ft of a fault that has been displaced in Holocene time. This requirement is intended to minimize the chances of a catastrophic failure resulting from an earthquake and is both relevant and appropriate to the disposal facility due to sufficient similarity of wastes and the purpose of the requirements.

- Regulation 40 CFR 264.18(b) restricts locating hazardous waste management facilities within a 100-year floodplain. This requirement is intended to prevent the spreading of contaminants during extreme flooding conditions and is both relevant and appropriate to the disposal facility due to sufficient similarity of wastes and the purpose of the requirements.

- Regulation 10 CSR 25-7.264(2)(N)1.A provides siting criteria for new hazardous waste landfills that identify a requirement for 9 m (30 ft) of soil or other material with a permeability of 1 x 10[7] cm/s or an equivalent protection based on at least 6 m (20 ft) of naturally occurring material for a landfill that receives only waste generated by its operator. Site characterization has demonstrated that present

site conditions will meet the above criteria and it is, therefore, reasonable that such conditions be retained. An explanation is presented below on how this condition will be retained once the disposal cell is constructed.

The on-site disposal facility will be constructed and maintained to provide equivalent protection. Much of the site overburden has already been considerably disturbed as a result of the extensive excavation, backfilling, and regrading activities that were conducted during plant construction many years ago. Thus, the existing overburden material, although naturally occurring, will not be the original, in-place material at the site. Therefore, the soil beneath the cell will be compacted to achieve a permeability at least as low a 1 x 10-7 cm/s over a depth of 6 m (20 ft). Compaction and permeability criteria are based on data collected during field permeability testing of in situ site soils using a two-stage borehole (TSB) procedure. As determined in the TSB testing, travel time and permittivity calculations were used to demonstrate that the soil units (Ferrelview Formation and clay till) comprising the foundation of the disposal facility will provide a level of protection superior to the State requirement 10 CSR 25-7.264(2)(N)1.A. The tests also determined that the soil units will satisfy the minimum soil performance requirement relative to the movement of hazardous constituents.

The intent of the overburden requirement is to provide a material that would retard contaminant migration so that groundwater would be protected from any impacts that could result from future leaching. The overburden soil, as explained above, will meet or exceed the permeability of 1 x 10-7. Other protective factors to groundwater include the cell components (i.e., the cover and liner) which will be engineered to limit infiltration and ensure that cell performance can be monitored, and post-closure monitoring which will detect any potential lapses in the integrity of the disposal cell facility.

- Regulation 10 CSR 25-7.264(2)(N)1.A(IV)(e) provides siting criteria for hazardous waste landfills which restrict locating new facilities in an area subject to catastrophic collapse. This requirement is intended to ensure long-term protection and is both relevant and appropriate to this action due to sufficient similarity of the regulated conditions. Previous studies have identified an area within the site boundary that complies with this standard. The cell will be located such that all waste materials are kept within that area. These studies are detailed in the Site Suitability Data Report (MKF and JEG 1991).

- Regulation 10 CSR 25-7.264(2)(N)2.D provides siting criteria for hazardous waste landfills which specify a 91 m (300 ft) buffer zone between the property line of the disposal facility and the actual landfill. The buffer zone provides an area which will be used only for monitoring and maintenance activities. This regulation is considered relevant and appropriate as discussed in Section 10.2.3.4.

In addition, Missouri Solid Waste Management Law 10 CSR 803.010(5)(C)(2) specifies a buffer zone of 50 ft (15 m) for landfills units. This regulation is considered relevant and appropriate as discussed in Section

10.2.3.4.

The proposed action will not impact historic, archeological, or cultural resources, sensitive ecosystems, or any threatened or endangered species.

As determined in the Feasibility Study (FS) (DOE 1992d), no other location-specific requirements were found to be either applicable or relevant and appropriate.

10.2.2 Contaminant-Specific ARARs

Contaminant-specific ARARs are health- or risk-based numerical values that establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the environment. Contaminant-specific ARARs were analyzed to identify each environmental law or regulation pertinent to the types of contaminants that will be encountered during the remedial action. This analysis included a review of the health and environmental protection standards for Uranium and Thorium Mill Tailings Actions (UMTRA), the Resource Conservation and Recovery Act (RCRA), the Missouri Radiation Regulations, the National Emission Standards for Hazardous Air Pollutants (NESHAP), the Clean Air Act, the Missouri Air Quality Standards, the Missouri Air Pollution Control Regulations, the Toxic Substance Control Act (TSCA), and the Clean Water Act. Several of the following standards were incorporated into the determination of cleanup criteria for contaminated soil at the Weldon Spring site (as explained in Section 2 of the FS).

NESHAP requirements for radionuclides (given in 40 CFR 61 Subparts H and Q) and asbestos (given in Subpart M) are applicable to the protection of the public during implementation of the remedial action. The NESHAP requirement for Rn-222 emissions (Subpart T) are relevant and appropriate as the site contains material sufficiently similar to uranium mill tailings, and the release requirements are well suited to final site conditions.

The NESHAP standards in 40 CFR 61 Subpart N set forth requirements for arsenic emissions. While this requirement is not considered a ARAR, because glass manufacturing is not part of the remedial action and commercial arsenic would not be used as a raw material, the requirement will be addressed in controlling emissions during implementation.

State air-quality standards found in 10 CSR 10-5.180, particulate standards for internal combustion engines, and 10 CSR 10-6.170, restriction of particulate matter to the ambient air are applicable to the implementation phase (including the excavation of borrow material) and will be met.

UMTRA 40 CFR 192.32(b)(1)(ii) addresses releases of radon from disposal areas after the closure period. These standards will be applicable after the bulk wastes have been placed in the disposal facility and the cover has been completed. At that time, the disposal area will meet the Rn-222 flux standards specified in 40 CFR 192.32(b)(1)(ii). These standards require reasonable assurance that Rn-222 releases will not exceed an average release rate of 20 pCi/m[2] sec.

Regulation 40 CFR 192, Subpart B addresses residual concentration levels of Ra-226 in soil. Residual levels should not exceed background by more than 5

pCi/g in the top 15 cm of soil or 15 pCi/g in each 15 cm layer below the top layer, averaged over an area of 100 m[2]. This standard applies to residual radium in soil at designated uranium processing sites. Because the Weldon Spring site is not a designated site, the standard is not applicable to this remedial action. However, it is relevant and appropriate because the contamination patterns at the Weldon Spring site are similar to those at the mill tailings sites. That is, there are no large volumes of subsurface radium-contaminated material with concentrations between 5 pCi/g and 15 pCi/g.

Regulation 40 CFR 192, Subpart E, specifies annual dose equivalent exposures to uranium and thorium by-product material as a result of planned discharges of radioactive material to the general environment. While the remedial action does not include a planned discharge of radioactive material, the requirements are relevant and appropriate to protection of the public during implementation of the action because the waste types are considered sufficiently similar. Subpart E also provides residual concentration limits for Ra-228 in soil. These levels, which are numerically identical to those given in Subpart B for Ra226, are considered to be relevant and appropriate to site conditions for the same reasons as described above.

The State quarterly Rn-222 limit of 1 x 10[-9] Ci/ml (1 pCi/l) above background in uncontrolled areas published in 19 CSR 20-10.040, Missouri Radiation Regulations, cannot be achieved during implementation of this action. It is possible that activities might result in temporary exceedances of the standard during the cleanup period. These activities are intermediate in nature, and are part of an overall remedial action that would attain compliance with this standard upon completion. Protection will be achieved by limiting exposure to workers. Because compliance with the requirement during remedial implementation is technically impracticable, this standard is waived under the provisions of Section 121(d)(4)(C) of the CERCLA during implementation: compliance with such requirements is technically impracticable from an engineering perspective.

Regulation 19 CSR 20-10.040 also specifies maximum permissible exposure limits for persons outside a controlled area. This requirement is applicable to the protection of the public during the implementation phase and will be met.

Regulation 40 CFR 261 includes levels for identification of hazardous wastes which are subject to hazardous waste regulations. Regulation 40 CFR 268 outlines the treatment standards for wastes restricted from land disposal. These regulations are applicable to the identification and disposal of listed or characteristic hazardous wastes.

Regulation 40 CFR 761, Subpart G deals with spills of materials contaminated with greater than 50 ppm polychlorinated biphenyls (PCBs). The standard specifies a soil decontamination level of 10 ppm PCBs. While any spills at the site would have preceded the effective date of the regulations, the recommended level of 10 ppm by weight was considered in developing cleanup criteria for PCBs in site soil.

If the vitrification alternative were to be implemented, the following standards would also be relevant and appropriate. Missouri air quality

standards (10 CSR 10-6.060) specify de minimus emission levels for specific pollutants that the vitrification system would have to meet. Regulation 10 CSR 105.030 places restrictions on emissions of particulate matter from fuel -burning equipment used for indirect heating. While such equipment would be used for direct heating of wastes in the vitrification system, this requirement would be relevant and appropriate based upon similarity of conditions.

10.2.3 Action-Specific ARARs

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken that are triggered by the particular remedial activities selected to accomplish the remedy. The analysis of action-specific ARARs addressed the following tasks for the selected remedy:

- Storage. Various contaminated materials are currently instorage at the chemical plant area as a result of interim response actions.

- Excavation. Removal of the contaminated sludge, soil, sediment, and vegetation from the chemical plant area and vicinity properties, and removal of the quarry bulk wastes and structural materials from the temporary storage areas at the chemical plant area.

- Treatment. Treatment of the raffinate-pit sludge and some soil and sediment by chemical stabilization/solidification and the structural materials by size/volume reduction.

- Disposal. Placement of all treated and untreated materials in an engineered disposal facility on site.

The analysis of action-specific ARARs for the contingency remedy addressed the same tasks, except that the treatment method for the sludge and soil was vitrification.

The ARARs for these activities are discussed in Sections 10.2.3.1 through 10.2.3.4.

10.2.3.1 Storage. As interim response actions prior to implementation of the final remedy, various wastes have been collected and placed in storage to prevent potential releases into the environment. Containerized chemical wastes (including PCB containerized waste) are stored in Building 434, and quarry bulk wastes will be stored at the TSA prior to placement in the on-site disposal facility. Building 434 contains approximately 2,500 drums of containerized wastes. It is estimated that 20% of the drums contain RCRA characteristic wastes, which includes approximately 190 drums of tributyl phosphate (TBP) waste. The TBP, which contains PCBs, mercury, uranium, and thorium, is being stored in Building 434 on an interim basis until proper treatment and disposal is determined. All RCRA and TSCA wastes are being stored in accordance with the RCRA and TSCA regulations (e.g., labeling, adequate roof and walls), with the exception of the storage limitation requirement discussed below. At the present time, no off-site treatment and disposal facilities have been identified that can or will accept the Weldon Spring site mixed waste. State and Federal ARARs that regulate the storage and management of these wastes are discussed below.

The facilities that manage or store RCRA wastes, or were designed to meet RCRA standards, will be closed in accordance with the substantive RCRA requirements (40 CFR 264, Subpart G). The RCRA requirements are applicable to the following facilities as they are used to treat, store, or dispose of RCRA wastes or were designed in accordance with RCRA requirements and were constructed after 1980: the chemical plant and quarry water treatment plant equalization basins; the temporary storage area; Building 434; and the chemical stabilization/solidification facility.

The Land Disposal Restrictions (LDRs) specified under RCRA prohibit the storage of restricted wastes (40 CFR 268 Subpart E) unless storage is solely for the purpose of accumulating sufficient quantities of wastes to facilitate proper treatment, recovery, or disposal. The EPA has issued two guidance documents that address the application of the LDR storage prohibitions to cleanup actions:

- Overview of the RCRA LDRs, Office of Solid Waste and Emergency Response (OSWER) Directive 9347.3-01FS, July 1989.

- Guide to Management of Investigation-Derived Wastes, OSWER Publication 9345.3-03FS, April 1992.

Both documents recognize that LDR wastes may be generated during cleanup actions and stored pending selection and implementation of the final remedy, and state that such storage is allowable under the LDR storage prohibition. Therefore, the limitations on storage time are waived under the provisions of Section 121(d)(4)(C) of CERCLA: compliance with such requirements istechnically impracticable from an engineering perspective.

Management of the quarry bulk wastes to be stored at the TSA is required to meet the NESHAP requirements for asbestos (40 CFR 61, Subpart M) as defined in the Record of Decision (ROD) for that action. During bulk waste removal, it is planned to place large asbestos-containing material (ACM) pieces (larger than 0.6 m x 0.6 m x 0.05 m [2 ft x 2 ft x 2 in.]) in appropriate bags and to place the bags in wind-tight, leak-tight metal boxes which will be transported to the asbestos storage area. Small pieces of asbestos, however, will be handled with the fine-grained soils. These small pieces that cannot practically be removed will be placed with the fine-grained soils at the TSA. This pile will be covered or sprayed with a foam to provide a wind-tight seal.

The smaller pieces that cannot be removed safely will not be segregated from the soil. Segregation is not technically feasible and could potentially increase exposure to personnel. Therefore, under this action, as this material is removed from the TSA, the NESHAP requirements are waived under the provisions of Section 121(d)(4)(B) of CERCLA: compliance with the requirement will result in greater risk to human health and the environment than the action that is proposed.

In accordance with the Missouri State Code of Regulations 10 CSR 25.5-262(2)(C)1, hazardous wastes stored prior to off-site shipment shall be in compliance with the packaging, marking, and labeling requirements of the Department of Transportation (DOT) regulations delineated in 49 CFR during

the entire on-site storage period. The wastes stored on site are packaged, labeled, and marked in accordance with the regulations effective at the time of containerization. Recently promulgated and future changes to the DOT regulations could greatly impact the operation of the on-site storage area by requiring a large quantity of containers to be repackaged (relabeling and remarking are administrative requirements). Continuing the efforts to maintain compliance with the transportation requirements for storage is not merited, primarily because these materials are not expected to be transported off site in the near term. Also, repackaging the waste in accordance with new DOT requirements (HM-181) could result in unnecessary personnel exposure. Prior to off-site shipment, the wastes will be re-packaged in accordance with applicable DOT requirements; therefore, the regulation 10 CSR 25.5-262(2)(C)1 is waived under provisions of Section 121(d)(4)(A) and Section 121(d)(4)(B) of CERCLA: the alternative is an interim measure and will become part of a total remedial action that will attain the applicable or relevant and appropriate Federal or State requirement and compliance with the requirement will result in greater risk to human health and the environment than the action that is proposed.

Regulation 40 CFR 761.65(a) requires that any PCB article or container be removed from storage and disposed of within one year from the date when it was first placed in storage. Under this action, PCB wastes will be stored in an adequate PCB storage facility (meeting the requirements of 40 CFR 761.65[b]) until final disposition of the PCB wastes can be accomplished. This requirement is waived under provisions of Section 121(d)(4)(A) of the CERCLA: this component is an interim measure and will become a part of a total remedial action that will attain the applicable or relevant and appropriate Federal or State requirement. This requirement could also be waived on the basis of impracticability since the PCB-contaminated waste is also radioactively contaminated and a disposal facility is not currently available for this type of waste.

10.2.3.2 Excavation. Excavation of contaminated areas will include removal of the contaminated sludge, soil, sediment, and vegetation from the chemical plant area and vicinity properties, and removal of the quarry bulk wastesand structural materials from the TSA at the chemical plant area.

Although most of the raffinate pit sludge does not exhibit RCRA characteristics, certain isolated pockets of the raffinate pit sludge have failed the TCLP test. Since it does not appear to be feasible to excavate the sludge in a manner that would separate the RCRA pockets from the non-RCRA material, the raffinate pit sludge will be managed as a characteristic waste for treatment purposes. After the raffinate pit sludge is removed, the clay bottom and soils beneath will be excavated to the soil cleanup criteria defined in Section 9.2. If the clay bottom and soils are determined to be characteristic hazardous waste, they will be treated in the CSS treatment plant. Other soil, sediments, past dump and spill areas are not considered RCRA wastes. These areas will be excavated to the extent of contamination, verified "clean" based upon the cleanup criteria and backfilled with uncontaminated soils.

The LDRs (40 CFR 268 Subpart C) place specific restrictions (e.g., treatment of waste to concentration levels) on characteristic RCRA hazardous waste prior to its placement in land disposal units. Certain activities carried

out under the remedial action may constitute placement; for example, placing sludge or sediment into a sedimentation tank and then redepositing the material back into the source area, or the movement of waste from one on-site area to another prior to treatment. These wastes will eventually be treated to the applicable specified treatment standards prior to placement in the disposal cell. Therefore, the LDRs are waived for these actions under the provisions of Section 121(d)(4)(A) of CERCLA; i.e., the alternative is an interim measure and will become part of a total remedial action that will attain the applicable or relevant Federal or State requirement.

10.2.3.3 Treatment. For the selected remedy, the hazardous waste treatment requirements specified in 40 CFR 264 and 10 CSR 25-7.264 areapplicable. These include general facility standards, preparedness and prevention standards, and standards for closure upon completion of the remedial action. All treated material must pass the toxicity characteristic leachate procedure (TCLP) test which will ensure adequate treatment. In addition, 40 CFR 264, Subpart X requirements for miscellaneous units are also applicable.

The LDRs (40 CFR 268 Subpart D) specify treatment standards which must be attained before LDR wastes or treatment residuals may be land disposed. LDR wastes fall into one of two categories; those wastes subject to concentration-based treatment standards (described in 40 CFR 268.43), and those wastes subject to specific technology treatment standards (described in 40 CFR 268.42). Compliance with a concentration-based treatment standard requires only that the treatment level be achieved. Once achieved, the waste may be land disposed. Most of the LDR wastes generated and stored at the Weldon Spring Site Remedial Action Project (WSSRAP) are subject to concentration-based treatment standards. These standards will be attained prior to land disposal.

The second type of treatment standard is based on the use of a specified technology. In these circumstances, a specific technology is required for the wastes, and as long as the wastes are treated by this technology, the treatment residuals are assumed to meet the treatment standards. Technologies other than those specified may be used to treat wastes subject to this type of treatment standard; however, it must be demonstrated to the appropriate regulatory agency that the alternative treatment method can achieve a measure of performance equivalent to that achievable by the specified technology. A limited amount of LDR wastes at the WSSRAP is subject to specified technology treatment standards. Given the limited national capacity for managing mixed waste, the specified technology may not be available.

A comprehensive site treatment plan as required by the FederalFacilities Compliance Act (FFCA), will be developed and implemented to evaluate and verify specified and alternative treatment technologies for the WSSRAP waste types. The plan will be consistent with the overall remedial action as controlled by the CERCLA process.

If it is determined that the specified technology treatment is not available for the LDR waste, the alternative treatment method would be implemented. In this case, the LDR treatment standard is waived under the provisions of CERCLA 121(d)(4)(D); however, the alternative must attain a standard of performance equivalent to that required under the specified technology

treatment standard. The effectiveness of the alternative technologies will be demonstrated by TCLP assurance testing prior to disposal. WSSRAP waste types and specified and alternative treatment technologies as described in the LDR standards are listed below:

1. TYPE OF WASTE: D001-High Total Organic Carbon (TOC) Nonwastewater
SPECIFIED TECHNOLOGY: Incineration, fuel substitution, or recovery
ALTERNATIVE TECHNOLOGY: Oxidation

2. TYPE OF WASTE: California List-Liquid hazardous wastes containing greater than or equal to 50 ppm PCBs SPECIFIED TECHNOLOGY: Incineration in accordance with 40 CFR 761.70 or burning in a high efficiency boiler in accordance with 40 CFR 761.60 ALTERNATIVE TECHNOLOGY: Oxidation followed by stabilization

3. TYPE OF WASTE: D008-Lead Batteries
SPECIFIED TECHNOLOGY: Thermal recovery in a lead smelter
ALTERNATIVE TECHNOLOGY: Stabilization

4. TYPE OF WASTE: D008-Radioactive Lead Solids
SPECIFIED TECHNOLOGY: Macroencapsulation
ALTERNATIVE TECHNOLOGY: Stabilization

5. TYPE OF WASTE: D009-Elemental Mercury Contaminated with Radioactive Materials
SPECIFIED TECHNOLOGY: Amalgamation
ALTERNATIVE TECHNOLOGY: Amalgamation followed by stabilization

The Best Demonstrated Available Technology (BDAT) for D008-nonwastewater wastes that are subject to a concentration-based treatment standard is stabilization.

Compliance with ARARs for the contingency (vitrification) remedy would be similar to that identified above, except that additional emission regulations requirements would be relevant and appropriate to the off gas from the vitrification facility. These requirements include Missouri air pollution control regulations for maximum allowable emissions of particulate matter from fuel-burning equipment used for indirect heating, restrictions for emissions of visible air contaminants, and restriction for emissions of particulate matter from industrial processes. State ambient air quality standards are also considered relevant and appropriate for Alternative 7a, insofar as the vitrification process would have a potential to emit pollutants above the de minimus emission levels specified in these regulations. Emission requirements for hazardous waste incineration under RCRA, as well as emission requirements for burning hazardous waste in boilers or industrial furnaces, are also relevant and appropriate for treatment of characteristic waste, because vitrification is considered similar to an industrial furnace (melting furnace). The substantive requirements will be met with emissions from the vitrification unit; however, actual permits are not required since this is an on-site CERCLA action.

10.2.3.4 Disposal. The primary environmental regulations that pertain to the design and operation of a newly constructed disposal facility are the

Solid Waste Disposal Act, the RCRA, the TSCA, the Missouri hazardous and solid waste management laws, and the UMTRA. None of these regulations are applicable to the combination of wastes to be disposed of; however, aspects from each may be relevant and appropriate to activities included in the design,

construction, and operation of the disposal facility. Table 10-1 shows the various requirements from each of these regulations and establishes whether it is relevant or appropriate and the rationale for the determination. Many requirements within the various regulations are similar or redundant and, in such an instance, the requirement that is considered more stringent is designated.

Although RCRA hazardous wastes regulations would be applicable to the excavation and treatment of hazardous wastes, the successful treatment to below RCRA characteristic levels would relieve these same wastes from any further jurisdiction as hazardous. While the RCRA requirements are not considered to be applicable to disposal operations, many are considered to be relevant and appropriate based primarily on the purpose of the requirements and the nature of the actions. The disposal facility shall comply with the substantive requirements of the TSCA with the exception of 40 CFR 761.75(b)(3). This requirement states the bottom landfill liner system or natural inplace soil barrier shall be at least 50 ft (17 m) from the historical highwater table. The volumes of TSCA wastes are expected to be limited, and any wastes containing greater than 50 ppm of PCBs will either be managed separately or the above requirement will be waived to allow disposal in the cell. This waiver is justified under the provisions of CERCLA 121(d)(4)(D), which states that the alternative will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, or limitation through use of another method or approach. Consequently, the RCRA requirements and the UMTRA requirements, which regulate the disposal of lowlevel radioactive wastes, are the primary ARARs for cell construction and operation activities.

For purposes of analysis, the disposal requirements of these lawsand their corresponding regulations can be grouped into the following categories: buffer-zone requirements, siting requirements, cover requirements, liner/leachate collection system requirements, and monitoring requirements.

As there are no buffer-zone requirements in the Federal regulations, the State of Missouri solid waste and hazardous waste regulations were reviewed for applicability or relevance and appropriateness to the on-site disposal facility. The Missouri solid waste regulation for a buffer zone (10 CSR 803.010[5][C][2]) requires a buffer zone of 15 m (50 ft) between the disposal facility and the property boundary. Given the nature of the site wastes, the need for monitoring and maintenance, and the impact on the integrity of the disposal facility, the Missouri solid waste requirement of a 15 m (50 ft) buffer zone is considered relevant and appropriate.

The Missouri hazardous waste regulation (10 CSR 25-7.264[2][N]2.D) specifies a 91 m (300 ft) buffer zone between the disposal facility and the property boundary. The Missouri Hazardous Waste requirement of a 91 m (300 ft) buffer zone is not applicable but is relevant and appropriate.

The intent of the buffer zone, in addition to ensuring that the public will not come in contact with the facility or its contents, is to allow adequate easement for operations, maintenance, and monitoring. Assuming a typical side slope of 3:1 for the covering of the waste cell, the buffer zone between the toe of the 3:1 dike (the area where the side slope meets the ground) and the property boundary will be at least 91 m (300 ft). However, for greater long-term integrity of the facility and enhancement of cell stability, additional clean-fill-dike material will be utilized at a flatter 5:1 slope. This extra clean-fill dike will not impinge on any operations, maintenance or monitoring of the disposal facility, and will provide better protection to the public.

In addition, in an effort to provide an additional safeguard, the DOE will attempt to acquire a small parcel of adjacent land from the Missouri Department of Conservation to extend the buffer zone to the degree practicable.

Siting. Siting criteria are discussed in the analysis of locationspecific ARARs.

Cover. Requirements are specified in the various laws for disposal facility covers. As discussed above, the optimal cover, on the basis of the wastes to be disposed of, is a hybrid cover that consists of the major features of a RCRA cover plus the features of an UMTRA cover aimed at long-term control of radon. The UMTRA standard in 40 CFR 192.32(b)(1) refers to the RCRA closure standard in 40 CFR 264.111 for nonradiological hazards. The UMTRA requirements in 40 CFR Part 192, Subpart D (which limit releases of Rn-222 so as not to exceed 20 pCi/m[2]s and which specify that the cover be effective for 1,000 years to the extent reasonably achievable, and in any case, for at least 200 years), are applicable because these requirements address by-product wastes as defined in the regulations. The RCRA design requirements in 40 CFR 264.310(a) are relevant and appropriate because they address similar actions.

Liner/Leachate Collection System. Design standards for liners and leachate collection systems are specified in the Missouri Code of State Regulations, the TSCA, and the RCRA; there are none in the UMTRA. Missouri solid waste regulations require at least 0.6 m (2 ft) of compacted soil with a hydraulic conductivity no greater than 10[-6] cm/s. Both the Missouri hazardous waste regulations and the RCRA specify a double-liner, double-leachate collection system for hazardous waste landfills. The TSCA requirements, which are broader and take into consideration the nature of the wastes and protectiveness of the overburden materials, require a liner consisting of 0.9 m (3 ft) of compacted soil with a permeability equal to or less than 1 X 10[-7] cm/s, ora synthetic membrane liner. The TSCA also provides for three different leachate collection systems: (1) simple leachate collection, (2) compound leachate collection, and (3) suction lysimeters.

Each of these three laws contains elements that should be considered relevant and appropriate; consequently, a hybrid system was selected on the basis of the following considerations: (1) all wastes to be disposed of are solid, nonhazardous wastes that are expected to generate only minimal leachate; (2) the site is underlain by thick, unsaturated, low-permeability

soils; and (3) it is prudent in the short term to remove precipitation, construction water, and transient drainage using a leachate collection system.

On the basis of the above, the hybrid system would consist of a single leachate collection system underlain by a composite liner. There are, however, other circumstances which affect the preferred design of the hybrid system by adding a secondary redundant liner and leachate collection system. These circumstances include site-specific considerations such as the presence of preexisting groundwater contamination in the area. Although a single leachate collection and removal system could be designed to remove leachate and prevent migration through the liner, there is no way to ensure that 100% of the leachate will be collected. Considering that the redundant leachate collection and removal system can also serve as a leak detection system, this second system is desirable, since it could establish whether or not elevated contaminant levels in the groundwater can be attributed to cell failure.

Other considerations include the fact that RCRA wastes are present at the site. It is planned that all RCRA characteristic wastes will be treated to below RCRA standards, and listed wastes would be managed off site. However, utilizing a cell design which is consistent with RCRA (double liner/leachate collection and removal system) may provide flexibility for the potential situationwhere RCRA wastes would be placed in the cell. (If this were to happen, an Explanation of Significant Difference would be prepared in accordance with EPA guidance for post-ROD changes.)

For these reasons, the RCRA requirements for a double liner/leachate collection system are considered relevant and appropriate.

A response action plan will be developed during the remedial design phase, which will specify response actions that will occur if excessive quantities of leachate are observed (i.e., during monitoring/maintenance or repair of the cap). Active management of the leachate collection system will continue until such time as it is agreed by the DOE and the regulatory agencies that it is no longer required.

Borrow source area activities will consist of the excavation and transfer along a dedicated haul road of approximately 1.9 million m[3] (2.5 million yd[3]) of clay material, which will be used for the construction of the disposal cell. Certain action-specific ARARs apply to these borrow source area activities. These ARARs contain administrative requirements that are applicable to the borrow area activity. Off-site actions must comply with all legally applicable requirements, both substantive and administrative.

The Land Reclamation Act (10 CSR 40-10.010) require obtaining a Land Reclamation Permit from the Land Reclamation Commission prior to surface mining of industrial minerals, including clay. However, a permit is not required of a governmental agency whose operations comply with the reclamation standards in RSMo. 444.774 and who registers with the Land Reclamation Commission prior to operations. The borrow area action will comply with the reclamation standards and will register with the commission.

The Clean Water Act requires a NPDES Permit for storm water discharges

associated with industrial activities from construction sitesinvolving the excavation or grading of five or more acres. This requirement is considered applicable to the borrow area because the extent of excavation at the borrow area is estimated at approximately 95 acres. Included as part of the permit process is a Water Pollution Prevention Plan, which will be prepared for the borrow area and which will include preventative measures for erosion control.

Monitoring and Maintenance. Requirements for post-closure monitoring and maintenance are specified in the RCRA and the UMTRA. The TSCA does not define specific post-closure requirements for a chemical waste landfill. Requirements under the RCRA specify a 30-year post-closure care period for maintenance of the cover, the leachate collection system, and the groundwater monitoring system. Groundwater monitoring requirements are set forth in the RCRA and the Missouri Code of State Regulations. The RCRA groundwater protection standard (40 CFR 264 Subpart F) sets forth general monitoring requirements. A groundwater monitoring program should provide representative samples of background water quality, as well as the quality of the groundwater passing the point of compliance. The sampling should allow for the detection of contaminant migration into the uppermost aquifer. State regulation 10 CSR 25-7.264(2)(f) sets forth surface water monitoring requirements to detect impacts from groundwater contamination. A sampling plan should provide representative background surface water quality (upgradient) samples as well as representative downgradient surface water quality samples. The initial values should be established for biological activity, chemical indicator parameters, and hazardous constituents by conducting quarterly sampling for one year. The surface water quality should be determined at least semiannually, and at those times when contaminant migration is greatest from the shallow groundwater to surface water. This monitoring should be conducted through the post-closure care period.

Post-closure standards under the UMTRA require the control of radiological hazards to (1) be effective for 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years; and (2) limit releases of Rn-222 so as not to exceed an average release rate of 20 pCi/m[2]s.

These UMTRA standards are relevant and appropriate because they address similar waste materials and a disposal scenario similar to the WSSRAP. The UMTRA requirements also directly reference the RCRA requirements of 40 CFR 264.111 with respect to the closure performance standard for nonradiological hazards. Therefore, 40 CFR 264.111 and 264.310 are also relevant and appropriate. Since the hazardous waste monitoring/maintenance requirements are more stringent than the solid waste requirements, the latter are not considered as ARARs.

Other Disposal Requirements. Other waste disposal issues include the restriction on the placement of waste containing free liquids in a landfill and a recommended minimum unconfined strength (UCS) for grout-like stabilized wastes. As required by 40 CFR 264.314 placement of wastes containing free liquids as defined by EPA Method 9095 (paint filter test) is restricted. Also, for grout-like materials resulting from the stabilization/solidification of wastes, a minimum UCS of 50 psi in place is recommended by EPA (EPA 1986 and EPA 1992b).

The free liquids restriction is not considered relevant with respect to CSS grout. Based on CSS testing of WSSRAP wastes, the free liquids restriction would likely prevent meeting waste placement objectives related to the proposed remedial action under Alternative 6a. Although the CSS grout resulting from the stabilization of raffinate sludge or contaminated soils may fail the paint filter test as a result of maintaining the needed fluidity for effective placement, long term benefits with respect to performance of the disposal facility would be realized. First, the grout resulting from the treatment of raffinate sludge or more highly contaminated soils will be used to fill voids in the materials from the dismantlement of buildings and foundations. With hardening of the grout to a minimum UCS of 50 psi, the stability of placed waste will be increased and long-term subsidence of the cell cover will be minimized. Second, by filling voids of dismantlement debris with a treated waste, the overall size of the cell is reduced by making use of the void space.

To compensate for free liquids in the grout that allows the grout to flow into voids of dismantlement debris, grout placement techniques can be developed and specified so that free liquids are effectively removed by the leachate collection system. Grout placement techniques could include thin enough lifts of grouted debris which will promote drainage of liquids and temporary sumps for collection and removal of liquids from the cell. Such measures could be demonstrated so that the requirements of 40 CFR 264.314(f) are achieved.

The restriction of free liquids from materials placed in the disposal cell, as specified in 40 CFR 264.314(f), is therefore waived only with respect to grout used in filling voids of dismantlement debris. It will be determined during pilot-scale testing that any free liquids generated during solidification process will pass TCLP. The free liquids will be randomly tested during full scale operations to ensure that they pass TCLP. Also, all groutlike material will achieve a minimum UCS of 50 psi in place at 28 days as documented through bench and pilot scale testing. Placement methods (e.g., compaction) that minimize long-term subsidence of the cell cover will be used for non-grout materials.

## 10.3 Cost-Effectiveness

The selected remedy is estimated to cost about $157 million and is estimated to require about 10 years to complete. These figures, however, arebased on preliminary conceptual design estimates and are likely to increase as engineering design is completed. The contingency treatment option is estimated to cost about $182 million and would also require about 10 years to complete. However, because the treatment technology employed in the contingency treatment option (vitrification) is an innovative technology, these estimates have greater uncertainty than those for the selected remedy; implementation of the contingency remedy is dependent upon the results of ongoing testing. The selected remedy is cost effective because it would achieve required objectives for the least cost and would use an established treatment technology. Thus, the potential for schedule delays and the resultant increased costs would be less for this remedy than for the other alternatives. The contingency treatment option would also be cost effective, assuming that results of ongoing and future bench-scale and pilot

-scale testing demonstrate that this option could be implemented at a cost and in a period of time comparable to that identified for the selected remedy. The increased cost of the vitrification technology would be somewhat offset by the increase in long-term protectiveness gained by the reduction in contaminant toxicity and volume.

Both the selected remedy and the contingency remedy would support comprehensive remediation of the Weldon Spring site by removal of the sources of contamination at the site and providing for disposal of all contaminated material generated from remediation of the site.

10.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which the permanent solutions and treatment technologies can be utilized in a costeffective manner. The selected remedy will result in the permanent removal of contaminated sludge, soil, sediment, and vegetation from the source areas and treatmentof the material posing the principal threats to the maximum extent practicable. Of those alternatives that are protective of human health and the environment and that comply with ARARs, the selected remedy provides the best balance among the alternatives in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. The selected remedy also meets the statutory preference for treatment as a principal element, and meets State and community acceptance.

The selected remedy will significantly reduce the hazards posed by the contaminated media through stabilization/solidification of contaminants such that the treated product will significantly reduce contaminant mobility. The treated and untreated material will both be placed in an engineered disposal facility designed to contain the materials over the long term. Because the more highly contaminated material will be treated to reduce contaminant mobility, the impact on human health and the environment would be minimal if the containment system were to fail.

The contingency treatment option would also provide for significant reductions in risk. Vitrification would be expected to provide somewhat greater long-term effectiveness because organic contaminants and some inorganic contaminants would be destroyed, and the contaminants in the treated waste form would be more thoroughly immobilized. However, larger uncertainties are associated with the implementability of vitrification compared with chemical stabilization/solidification, and thus could lead to project delays and increased costs. Vitrification is being carried forward as a contingency treatment option so the effectiveness of this technology can continue to be evaluated in terms of current uncertainties associated with its implementability.

The selected remedy treats the material posing the principalthreats at the site, achieving significant reduction in contaminant mobility. Chemical stabilization/solidification and disposal on site is more effective in the short term, requiring up to five years to implement the treatment operations and 10 years to complete remedial action at the site. In comparison, vitrification will require about seven years for implementation, provided

engineering scale-up and design are not delayed because of the innovative nature of this technology. The off-site disposal alternatives could require significantly more time to implement due to the increased administrative requirements for transport and disposal of the wastes at the off-site facilities.

The off-site disposal alternatives do not offer an increase in effectiveness over the on-site disposal alternatives that can justify the greatly increased costs (two to 10 times the cost of the selected remedy). The longterm effectiveness of the off-site alternatives would be somewhat greater at the Weldon Spring site due to the removal of contaminated material from the site, and potential long-term impacts at the off-site locations would be less than those expected at the Weldon Spring site for on -site disposal, because of the arid climate and distance to potential receptors. However, shortterm impacts would be greater due to the increased handling of contaminated materials and the transportation of those materials to the off-site locations. In addition, implementation of these alternatives would require coordination of licensing, permitting, regulatory compliance, and establishment of administrative procedures (as appropriate) in order to dispose of the Weldon Spring waste at either off-site facility.

The major balancing criteria that provide the basis for selection of the preferred alternative are short-term effectiveness, implementability, and cost. The selected remedy can be implemented more quickly, with les difficulty, and at less cost than the other alternatives and is thereforedetermined to be the most appropriate method. The contingency treatment option is being retained to facilitate implementation of an alternate treatment technology in the event that chemical stabilization/solidification does not perform adequately. Both technology types will be reevaluated against the balancing criteria during conceptual design and bench-scale and pilot-scale testing. If the contingency treatment option (vitrification and disposal on site) were selected pursuant to this continuing evaluation, an Explanation of Significant Differences from the selected remedy would be made available to the public, and public input would be solicited.

## 10.5 Preference for Treatment as a Principal Element

The selected remedy satisfies the preference for treatment as a principal element by treating the materials giving rise to the principal hazards at the site (the raffinate-pit sludge and the more highly contaminated fraction of soil, sand, and sediment) by chemical stabilization/solidification. This treatment method will significantly reduce contaminant mobility. The contingency remedy would also satisfy the preference for treatment as a principal element by treating these same materials by vitrification. Vitrification would also significantly reduce contaminant mobility. In addition, vitrification would reduce contaminant toxicity by destruction of organic contaminants and some inorganic contaminants, and waste volume would be reduced through the elimination of water and void spaces during the melting process.

## 10.6 Irreversible and Irretrievable Commitment of Resources

Implementing the selected remedy will result in the permanent commitment of

land at the Weldon Spring site for waste disposal. This commitment of land for the disposal facility is consistent with current land use at the site. The Weldon Spring site is a contaminated, inactive industrial complex underthe custody of the DOE, and it contains waste pits from past disposal practices; it is adjacent to a similar contaminated site owned by the Army.

The disposal cell proper is expected to cover about 17 ha (42 acres), but the total amount of committed land would be larger (e.g., double the waste containment area) because a buffer zone will be established around the cell. No other area of the Weldon Spring site would sustain a long-term impact or injury as a result of this permanent remedy. Perpetual care will be taken of the committed land because the waste would retain its toxicity for thousands of years. For example, the cover will be visually inspected, groundwater will be monitored, and the effectiveness of the overall system at the Weldon Spring site will be reviewed at least every five years.

Consumptive use of geological resources (e.g., quarried rock, sand, and gravel) and petroleum products (e.g., diesel fuel and gasoline) will be required for the removal, construction, and disposal activities. Adequate supplies of these materials are readily available in the Weldon Spring area. The treatment process will also require the consumptive use of materials (including cement and fly ash) and energy. Cement and fly ash are readily available locally in the quantities required, and natural gas can be obtained from the local utility. Implementing the selected remedy is not constrained by the availability of resources or supplies beyond those currently available in the St. Louis area.

## 10.7 Significant Changes

The Proposed Plan for the Weldon Spring site was released for public comment in November 1992. The Proposed Plan identified Alternative 6a, Removal, Chemical Stabilization/Solidification and Disposal On Site, as the preferred alternative. The DOE reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy, as it was originally identified in the Proposed Plan, were necessary.

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| 10 CFR 20 | Standards for Protection Against Radiation |
| 29 CFR 1910 | OSHA Standards |
| 40 CFR 6 (Wetlands) | Appendix A EPA Regulations for Implementing EO 11990 and EO 11988 (Floodplains) |
| 40 CFR 61 | EPA NESHAPs National Emissions Radionuclides |
| 40 CFR 190 | Environmental Radiation Protection Standards for Nuclear Power Operations |
| 40 CFR 192 | UMTRA Standards |
| 40 CFR 241 | EPA Solid Waste Guidelines |
| 40 CFR 261 | EPA Identification and Listing of Hazardous Waste |
| 40 CFR 264 | EPA Standards for o/o of Hazardous Waste Treatment, Storage, and Disposal Facilities |
| 40 CFR 268 | EPA Land Disposal Restrictions |
| 40 CFR 300 | CEQ National Oil and Hazardous Substances Pollution Contingency Plan |
| 40 CFR 761 | EPA PCB Regulations |
| 40 CFR 763 | EPA TSCA Asbestos Regulations |
| 49 CFR 170-177 | Department of Transportation Hazardous Transportation Regulations |

DOE Orders

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| 5480.11 | Radiation Protection for Occupational Workers |
| 5400.5 | Radiation Protection of the Public and the Environment |

Federal Executive Order

11988 Floodplain Management

11990 Protection of Wetlands

Missouri State Regulations

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| 10 CSR 10-5.030 | Maximum Allowable Emission of Particulate Matter from Fuel Burning Equipment Used for Indirect Heating |
| 10 CSR 10-5.050 | Restriction of Emission of Particulate Matter from Industrial Processes |
| 10 CSR 10-5.090 | Restriction of Emission of Visible Air Contaminants |
| 10 CSR 10-5.180 | Emission of Visible Air Contaminants from Internal Combustion Engine |
| 10 CSR 10-6.010 | Ambient Air Quality Standards |
| 10 CSR 10-6.060 | Permits Required |
| 10 CSR 10-6.170 | Restriction of Particulate Matter to the Ambient Air Beyond the Premises of Origin |
| 10 CSR 25-7.264 | Missouri Hazardous Waste Treatment, Storage and Disposal Requirements |
| 19 CSR 20-10.040 | Missouri Radiation Regulations |

Missouri Register, September 1, 1992; Vol. 17, No. 17.
Missouri Register, November 2, 1992; Vol. 17, No. 21.

Other Orders

Missouri Governor's Executive Order 82-19 on Flood Plain Management

12 ACRONYMS

| | |
|---|---|
| AEA | Atomic Energy Act |
| AEC | U.S. Atomic Energy Commission |
| ALARA | as low as reasonably achievable |
| ARAR | applicable or relevant and appropriate requirements |
| BA | baseline assessment |
| BDAT | best demonstrated available technology |
| CAA | Clean Air Act |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| CSS | chemical stabilization/solidification |
| CWA | Clean Water Act |
| DAC | derived air concentration |
| DCF | dose conversion factor |
| DCG | derived concentration guideline |
| DNB | dinitrobenzene |
| DNT | dinitrotoluene |
| DOE | U.S. Department of Energy |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| ERDA | Energy Research and Development Administration |
| FS | feasibility study |
| LDR | Land Disposal Restrictions |
| MCL | maximum contaminant level |

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|---|---|
| MCLG | maximum contaminant level goals |
| MSA | material staging area |
| NAAQS | National Ambient Air Quality Standards |
| NB | nitrobenzene |
| NCP | National Contingency Plan |
| NEPA | National Environmental Policy Act |
| NESHAP | National Emission Standards for Hazardous Air Pollutants |
| NPDES | National Pollutant Discharge Elimination System |
| NPL | National Priorities List |
| NRC | Nuclear Regulatory Commission |
| OSHA | Occupational Safety and Health Administration |
| OSWER | Office of Solid Waste and Emergency Response |
| PAH | polycyclicpolynuclear) aromatic hydrocarbons |
| PCB | polychlorinated biphenyl |
| PP | Proposed Plan |
| RCRA | Resource Conservation Recovery Act |
| RfD | reference dose |
| RI | remedial investigation |
| RI/FS | Remedial Investigation/Feasibility Study |
| RI/FS-EIS | Remedial Investigation/Feasibility Study-Environmental Impact Statement |
| ROD | Record of Decision |
| SDWA | Safe Drinking Water Act |
| SWDA | Solid Waste Disposal Act |
| TCLP | toxicity characteristic leaching procedure |
| TNB | trinitrobenzene |
| TNT | trinitrotoluene |
| TSA | temporary storage area |
| TSCA | Toxic Substance Control Act |
| UMTRA | Uranium Mill Tailings Remedial Action |
| UMTRCA | Uranium Mill Tailings Radiation Control Act of 1978 |
| WLM | working-level month |

# *WELDON SPRING QUARRY/PLANT/PITS (USDOE/ARMY)*

## Site Information:

**Site Name:** WELDON SPRING QUARRY/PLANT/PITS (USDOE/ARMY)
**Address:** ST. CHARLES COUNTY, MO

**EPA ID:** MO3210090004
**EPA Region:** 07

## Record of Decision (ROD):

**ROD Date:** 09/30/1998
**Operable Unit:** 05
**ROD ID:** EPA/541/R-98/166

**Media:** Groundwater, Sediment, Soil, Surface Water

**Contaminant:** Inorganics, Metals, Nitroaromatics, PAH, PCBs, Radioactive

**Abstract:** Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The U.S. Department of Energy's (DOE) Weldon Spring site consists of two distinct geographical areas: 1) the quarry area, and 2) the chemical plant area. Both areas are located in St. Charles County, Missouri. Much of the land surrounding the quarry consists of state-owned conservation areas containing second growth forest. Non-forested areas are largely used for crop production and pasture or are old-field habitat. Aquatic habitats in the vicinity of the site include the Missouri River, Little Femme Osage Creek, Femme Osage Slough and numerous small unnamed creeks, drainages and ponds throughout the Weldon Conservation Area.

The quarry was used by the Army for disposal of chemically contaminated materials in the 1940s and was later used for the disposal of radioactively contaminated material by the Atomic Energy Commission in the 1960s.
Unconsolidated surficial materials are present in the area of the Weldon Spring quarry. The uppermost bedrock unit in the vicinity of the quarry is the Kimmswick Limestone. The contact between the

Kimmswick Limestone and the underlying Decorah Group, which may provide primary pathways for contamination migration from the quarry area, is in contact with fine-grained soils, silty clay, and organic silt and clay north of Femme Osage Slough.

A Record of Decision (ROD) was completed in 1990 for the Quarry Bulk Waste Operable Unit (OU). A ROD was completed in 1998 for the Quarry Residuals OU.

**Remedy:** The selected remedy consists of the major components described in detail in the paragraphs below. A long-term groundwater monitoring strategy will be implemented to confirm expectations that significant impacts to the Missouri River alluvial aquifer will not occur and that conditions at the quarry area will continue to be protective of human health and the environment.

Institutional controls will be necessary to prevent uses inconsistent with recreational use or uses that would adversely affect contaminant migration. The Department of Energy will continue to coordinate with the Missouri Department of Conservation and the Missouri Department of Natural Resources-Parks to establish a written agreement, such as a license agreement, memorandum of understanding, or deed attachment, outlining and agreeing to the terms of the institutional controls. Terms may include limiting access to groundwater north of the slough for the following uses: irrigation, consumption, or as a surface water source. The terms of the agreement will be evaluated at each five-year review, at which time changes or deletions to the terms would be made, as appropriate. The Well Field Contingency Plan provides for ongoing availability of a safe water supply.

The quarry proper will be restored through backfilling with soil to reduce fall hazards, stabilize the highwalls, eliminating ponding of surface water, and minimize infiltration through the inner quarry to the groundwater. Dismantling of facilities utilized during bulk waste removal activities would also be performed at this time.

Estimated Capital Costs: $150,000.
Estimated Annual O&M: $600,000.
Estimated Present Worth Costs: not provided.

**Text:** Full-text ROD document follows on next page.

EPA 541-R98-166

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RECORD OF DECISION: DOE/OR/21548-725

Record of Decision for Remedial Action
for the, Quarry Residuals Operable Unit
at the Weldon Spring Site,
Weldon Spring, Missouri

September 1998

prepared by
U.S. Department of Energy, Oak Ridge Operations Office, Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri

<IMG SRC 98166A>

U.S. Department of Energy
Weldon Spring Site Remedial Action Project
Weldon Spring, Missouri

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September 1998

# DECLARATION STATEMENT

## Site Name and Location

Weldon Spring Quarry
St. Charles County, Missouri

## Statement of Basis and Purpose

This Record of Decision (ROD) presents the selected remedial action for the Quarry Residuals Operable Unit (QROU) of the U.S. Department of Energy's Weldon Spring Site in St. Charles County, Missouri. This action was selected following requirements of the Comprehensive Evironmental Response, Compensation, and Liability Act (CERCLA), as amended, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. National Environmental Policy Act (NEPA) issues related to the quarry area have also been addressed and have been integrated into the CERCLA decision-making process for the QROU.

This decision is based on the Administrative Record for the QROU. Major documents include the (1) RI/FS Work Plan, (2) Remedial Investigation and Baseline Risk Assessment Reports, (3) Feasibility Study Report, and (4) Proposed Plan. Public comments received during the review period for the Proposed Plan were considered and have been incorporated into this decision.

The State of Missouri concurs with the selected remedy.

## Assessment of the Site

The response action selected by this ROD addresses actual or threatened releases of hazardous substances from this site that were not addressed under previous response actions.

## Description of the Select Action

The QROU is the second of two operable units established for the quarry area of the Weldon Spring site. The first operable unit, the Quarry Bulk Waste Operable Unit, addressed the excavation and relocation of the source materials located in the quarry proper. This operable unit addresses residual conditions at the quarry, including contaminated groundwater and surface water. Based on exposure assessments under current and reasonably anticipated land uses, no further action is necessary to protect human health and the environment. However, because contamination will remain on-site, long-term monitoring will be undertaken as described below.

The major components of the selected remedy are:

- Monitor long term to verify that conditions at the quarry area and the St. Charles County well field remain protective of human health and the environment;

- Implement institutional controls to prevent uses inconsistent with recreational use or uses that would adversely affect contaminant migration.

Further sampling activities are planned for two purposes. Given the presence of significant levels of contamination in quarry groundwater north of the slough, which is in close proximity to the St. Charles County well field, and the reliance on natural systems to limit potential exposure, a field test will be performed to further evaluate the effectiveness of groundwater remediation. This activity will include the operation of a pilot-scale extraction trench. Sampling will also be performed to establish the extent of contamination for the two soil areas (i.e., the northeast slope and the ditch area near the transfer station) within the quarry proper. Preliminary sampling has indicated the presence of radiological contamination. A complete characterization of these areas could not be performed because access to these areas is limited. If contaminant levels are found to be unacceptable following a risk evaluation, these areas will be addressed under a subsequent response action.

Statutory Determinations

The selected action is protective of human health and the environment, complies with applicable or relevant and appropriate requirements, and is cost effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. This remedy does not satisfy the statutory preference for treatment as a principal element of the remedy.

Because groundwater contamination will remain at the quarry at levels that exceed those for unlimited land use and unrestricted exposure, a review will be conducted within five years after commencement of the action to evaluate conditions at the quarry area and to ensure that the remedy continues to provide adequate protection of human health and the environment. The five-year reviews will be developed in consultation with the U.S. Environmental Protection Agency and the Missouri Department of Natural Resources and will be made available to the public for review and comment.

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## NOTATION

The following is a list of the acronyms, initialisms, and abbreviation (including units of measure) used in this document. Acronyms and abbreviations used only in tables and figures are defined in the respective tables and figure captions.

### ACRONYMS, INITIALISMS, AND ABBREVIATIONS

| | |
|---|---|
| ARAR | applicable or relevant and appropriate requirement |
| BRA | baseline risk assessment |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| COPC | contaminant of potential concern |
| CSR | Code of State Regulations |
| 1,3-DNB | 1,3-dinitrobenzene |
| 2,4-DNT | 2,4-dinitrotoluene |
| DOE | U.S. Department of Energy |
| EPA | U.S. Environmental Protection Agency |
| FS | feasibility study |
| MCL | maximum contaminant level |
| MDNR | Missouri Department of Natural Resources |
| MDOH | Missouri Department of Health |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NPDES | National Pollutant Discharge Elimination System |
| NPL | National Priorities List |
| O&M | operation and maintenance |
| PP | proposed plan |
| QROU | quarry residuals operable unit |
| RD/RA | remedial design/remedial action |
| RI | remedial investigation |
| RI/FS | remedial investigation/feasibility study |
| ROD | Record of Decision |
| TBC | to-be-considered (requirement) |
| WSCC | Weldon Spring Citizens Commission |
| WSSRAP | Weldon Spring Site Remedial Action Project |

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Units of Measure

| | | | |
|---|---|---|---|
| cm | centimeter(s) | m | meter(s) |
| ft | foot (feet.) | m 3 | cubic meter(s) |
| g | gram(s) | µg | microgram (s) |
| gal | gallon(s) | mi | mile(s) |
| gpm | gallon(s) per minute | mL | milliliter(s) |
| ha | hectare(s) | pCi | picocurie(s) |
| km | kilometer(s) | ppm | part(s) per million |
| L | liter(s) | s | second(s) |
| | | yd 3 | cubic yard(s) |

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# RECORD OF DECISION FOR REMEDIAL ACTION FOR THE QUARRY RESIDUALS OPERABLE UNIT AT THE WELDON SPRING SITE, WELDON SPRING MISSOURI

## 1 SITE HISTORY

The Weldon Spring Quarry is one of two noncontiguous areas that constitute the U.S. Department of Energy's (DOE) Weldon Spring site. The main area of the site is the chemical plant. Both areas are located in St. Charles County, Missouri, about 48 km (30 mi) west of St. Louis (Figure 1). The U.S. Environmental Protection Agency (EPA) listed the quarry on the National Priorities List (NPL) in 1987, and the chemical plant area was added to the list in 1989. The quarry is about 6.4 km (4 mi) south-southwest of the chemical plant area, it is accessible from State Route 94 and is currently fenced and closed to the public (Figure 2). The quarry is approximately 300 m (1.000 ft) long by 140 m (450 ft) wide and covers an area of approximately 3.6 ha (9 acres).

The quarry was used by the Army for disposal of chemically contaminated (explosive) materials in the 1940s and was later used for the disposal of radioactively contaminated material by the Atomic Energy Commission (AEC) in the 1960s.

Approximately 110,000 m 3 (144,000 yd 3) of soil and waste material was removed from the quarry and transported to the chemical plant area as part of completing the remedial action

stipulated in the Record of Decision (ROD) for the Quarry Bulk Waste Operable Unit (DOE 1990). Bulk waste removal was completed in October 1995. These wastes have been placed in the disposal cell at the chemical plant. Prior to bulk waste removal, contaminated water contained in the quarry
pond was also removed; approximately 170 million L (44 million gal) has been treated as of March 1998.

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## 2 SCOPE AND ROLE OF REMEDIAL ACTION

The Quarry Residuals Operable Unit (QROU) the second of two Operable units established for the quarry area of the Weldon Spring Site. The first operable unit, referred to as the
Quarry Bulk Waste Operable Unit, addressed the excavation and relocation of the source materials within the quarry to temporary storage at the chemical plant area. Bulk waste excavation was carried
out in conjunction with a removal action to extract, treat, and discharge contaminated water from
the quarry sump. This operable unit addresses residual conditions at the quarry, including (1)residual
contamination at the quarry proper, (2) the Femme Osage Slough and nearby creeks, and
(3) contaminated groundwater located north of the Femme Osage Slough.

The Weldon Spring site consists of two distinct geographical areas (1) the quarry area, which is the subject of this ROD, and (2) the chemical plant area. Under the chemical plant ROD, wastes and contaminated media from the chemical plant area and the quarry area will be disposed of in an on-site cell. The only remaining remedial decision to be made for the Weldon Spring site
concerns the management of contaminated cyroundwater at the chemical plant area.



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## 3 COMMUNITY PARTICIPATION

A remedial investigation/feasibility study (RI/FS) process was conducted for the QROU of the Weldon Spring site in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, to document the proposed management of the quarry proper. the Femme Osage Slough and nearby creeks, and quarry groundwater north of the Femme Osage Slough as components of the QROU Documents developed during the RI/FS process included the Remedial Investigation (DOE 1998d), Baseline Risk Assessment (BRA)(DOE 1998a), Feasibility Study (DOE 1998b), and Proposed Plan (PP) (DOE 1998c). Together, the RI, BRA, FS, and PP constitute the required primary documents, consistent with the provisions of the First Amended Federal Facility Agreement entered into between DOE and the EPA. In accordance with Section 117 of CERCLA, copies of these final documents were released to the public on March 18, 1998.

The RI, BRA, FS, and PP, along with other documents in the Administrative Record, have
been made available for public review at the Weldon Spring site. Copies also have been made available to the public in information repositories at Francis Howell High School and at four branches of the St. Charles City/County Library: Kathryn M. Linneman, Spencer Creek, Middendorf-Kradell, and Kisker Road. A notice of availability of these documents was published in the St. Charles Journal on March 22 and April 5, 1998.

A public comment period for this remedial action was held from March 18, 1998, through May 21, 1998. A public hearing was held on April 16, 1998, at the Administration Building of the Weldon Spring Site Remedial Action Project (WSSRAP) as a part of the public participation process. This public hearing was advertised in the newspaper cited above. At this meeting, representatives from DOE and EPA Region VII received comments from the public about the site and the remedial alternatives under consideration. Transcripts of the public meeting are included as
part of the Administrative Record for this operable unit remedial action. The Administrative Record
includes the information considered in deciding on the selected action. All public comments, oral
and written, were considered in the decision-making process for determining the selected action (see
Appendix A).



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# 4 SITE CHARACTERISTICS

## 4.1 SOIL AND GEOLOGY

Unconsolidated surficial materials are present in the area of the Weldon Spring quarry: loess deposits and residual soils cover the upland regions, and alluvium occurs along the stream and
river valleys. Coarse-grained deposits constitute the bottom 6 to 24 m (20 to 80 ft) of the Missouri
River floodplain. Fine-grained deposits constitute the upper 4.6 to 7.6 m ( 15 to 25 ft) of the Missouri

River floodplain and the full thickness of Little Femme Osage Creek and the Femme Osage Creek alluvium (DOE 1998d).

The uppermost bedrock unit in the vicinity of the quarry is the Kimmswick Limestone. The Kimmswick Limestone is underlain in descending order by the Decorah Group, Plattin Limestone, Joachim Dolomite, and St. Peter Sandstone (see Figure 3). The sides of the quarry expose the Kimmswick Limestone, whereas the bedrock floor of the quarry lies in the upper portion of the Decorah Group. The contact between the Kimmswick Limestone and Decorah Group, which may provide the primary pathways for contaminant migration from the quarry area, is in contact with fine-
grained soils, silty clay, and organic silt and clay north of Femme Osage Slough (DOE 1998d).

## 4.2 HYDROGEOLOGY/GROUNDWATER

Groundwater in the vicinity of the quarry occurs in alluvium, fractured limestone, and Sandstone (Berkeley Geosciences Associates 1984). The uppermost groundwater unit is composed of carbonate rocks near the quarry, tributary alluvium near little Femme Osage Creek, and Missouri
River alluvium between the quarry bluff and the Missouri River. Water table (unconfined) conditions
typically occur in the alluvium; confined to semiconfined conditions occur in the bedrock and alluvium where layers of varying permeability are present. The St. Peter Sandstone, approximately
90 m (300 ft) below the floor of the quarry, constitutes the deeper aquifer.

In the vicinity of the quarry, groundwater flows primarily from north to south, and a westward gradient runs from the quarry to Little Femme Osage Creek. South of the quarry rim, the direction of the groundwater flow is generafly south to southeast toward the Femme Osage Slough. In the alluvium south of the slough, groundwater is within 3 m (10 ft) of the ground surface, although
the depth to water varies with seasonal pumping demands in the nearby St. Charles County well field
and with water levels in the Missouri River.

For the purposes of this action, alluvial aquifer in the vicinity of the quarry is composed of
two horizons: the overlying fine-grained deposits and the underlying coarse-grained deposits referred



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FIGURE 3 Cross Section through the Quarry Area

to as the Missouri River alluvium. The deep bedrock aquifers underlying, the alluvial deposits are
considered outside the area of potential impacts from this site.

The upper horizon is fine grained and has low, yet spatially variable, hydraulic

conductivity
because of the heterogeneous nature of the clay and silty clay materials composing this unit. In a
marginal zone that lies between the bluff and the slough, the full sequence of materials consists of
the fine-grained deposits. Only in two bedrock lows, which extend into this area, do coarser materials
(silt and fine sand) occur. Groundwater impact from quarry contaminants is generally confined to
the fine-grained materials. Well yields in this area typically range from less than 0.03 to 0.16 L/s
(0.5 - 2.5 gpm); these yields are not sustainable for any length of time, and the wells typically
dewater. The lower yields occur in the low conductivity clay and silty clay materials, whereas the
higher yields occur in the wells situated in the previously described bedrock lows. Consistent with
the EPA's guidelines for groundwater classification, groundwater in this zone is not considered a
potential source of drinking water because yields are insufficient to sustain any routine production
sufficient for household use.

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The Missouri River alluvial aquifer in which the St. Charles County well field is located is the principal aquifer in the area. The alluvial aquifer thins to the north, away from the river, until
it is truncated by the risin2 bedrock and the overlaying fine-grained unit. The alluvial aquifer is
characterized by to 24 m (20 - 80 ft) of coarse-grained deposits consisting of fine- to medium-grained sand with some silt that grades with depth to coarse-grained sand with cobbles and boulders.
These deposits are overlain by 5 to 8 in (15 -25 ft) of fine-grained deposits. Recharge to the coarse
grained materials occurs primarily from the Missouri River, intermittent surface flooding, infiltration
of precipitation, amd discharge from the underlying bedrock.

The hydraulic gradient between the bluff and the slough is generally southward toward the
slough. In general, the groundwater elevation data indicate a southeasterly gradient across the slough.
At most locations, the slough is a source of recharge to the shallow groundwater. However, at some
locations north of the slough, groundwater levels are higher, which indicates discharge to the slough
(DOE 1998d).

A notable decrease of uranium (from 3,400 to 10pCi/L) occurs over a short distance (30 to
91 m [100 - 300 ft]) north of the slough, which indicates that processes other than dilution are

reducing the amount of dissolved uranium in groundwater. These processes include sorption onto the aquifer matrix and organics and precipitation of dissolved uranium from the groundwater. Uranium migration in the groundwater will be limited to some extent by sorption onto the aquifer materials. Site-specific distribution coefficient estimates range from 5 to 50 m.L/g for materials north of the slough. Contaminant removal from groundwater via precipitation of solid phases typically results from changes in geochernical conditions in the aquifer system. In the shallow aquifer north of the slough, uranium activity decreases abruptly near the northern margin of the slough in response to a sudden decrease in the oxidation potential, which is coincident to a reduction of dissolved uranium in groundwater. The sharp decrease in uranium levels indicates that sorption, which typically generates more diffuse boundaries, is not the only process attenuating the uranium in groundwater.

## 4.3 BIOTIC RESOURCES

Much of the land surrounding the quarry consists of state-owned conservation areas containing second-growth forest. Nonforested areas, which cover much of St. Charles County, are largely used for crop production and pasture or are old-field habitat.

Aquatic habitats in the vicinity of the quarry include the Missouri River, Little Femme Osage Creek, Femme Osage Slough, and numerous small, unnamed creeks, drainages, and ponds throughout the Weldon Spring Conservation Area. In addition, the nearby August A. Busch Memorial Conservation Area contains more than 35 ponds and lakes; however, these ponds and lakes are in the Mississippi River drainage and are not influenced by the quarry area.



The U.S. Fish and Wildlife Service (Frazer 1995; DOE 1998d) has identified the potential for five federal-listed threatened or endangered species to occur in the vicinity of the quarry area: three birds (bald eagle, peregrine falcon, and interior least tern), one fish (pallid sturgeon), and one plant (decurrent false aster). The Fish and Wildlife Service has also identified several candidate species as possibly occurring in the area. The Missouri Department of Conservation has identified 13 state endangered and 19 state rare species for St. Charles County (Dickneite 1995). However, many of these species are not expected to occur at the quarry area; some only pass through the area during migration. For other species, suitable habitat is absent from the quarry. To date, only the bald eagle has been observed in the vicinity of the quarry area (DOE 1998d); all of those birds were sighted near the Missouri River and away from the quarry proper.

## 4.4 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination at the QROU are discussed in detail in the RI (DOE 1998d). Contaminated media at the QROU can be generally categorized into three separate entities: (1) residual contamination at the quarry proper, (2) the Femme Osage Slough and nearby creeks (Little Femme Osage Creek and Femme Osaae Creek), and (3) quarry groundwater north of

the Femme Osage Slough. A summary of the data collected to support the RI is presented in Table 1.
Samples were also collected for each medium of concern to delineate naturally occurring levels of
chemical and radiological constituents (i.e., background levels) from those levels that may have resulted from site activities.

4.4.1 Soil

At the quarry proper, soil was sampled from the rims and slopes, and sediment was sampled from wall and floor fractures and from the ramp and floor of the quarry sump. Potential contaminants
identified in soil samples from the rims and slopes included several metals, radionuclides, nitroaromatic compounds, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs). In disturbed soil on the rim and knoll of the quarry, only selenium, silver, zinc, radium-226,
thorium-230, and uranium-238 were detected at concentrations significantly higher than background
levels. In samples from the quarry fractures, lower levels of contamination were found in the wall
fractures than in floor fractures. Radium, thorium, and uranium isotopes, and aluminum, selenium,
and silver were detected at some fractures at concentrations exceeding backaround levels. Samples
collected from the sump area were primarily contaminated with radium-226, thorium-230, uranium, and low levels of PAHs.

Outside the quarry proper, surface and subsurface soil samples were collected, with a focus
on the area south of the quarry between the Katy Trail and Femme Osage Slough. The area sampled included Vicinity Property 9, which was remediated in 1996. Low concentrations (but higher than
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background levels) of uranium are sorbed onto soils located between the quarry and the slough. Lead
and zinc were detected at low levels above background in shallow soils south and east of the quarry.
Low levels of nitroaromatic compounds (i.e.. <1.7 ppm) were detected in soils to the east, west, and
south of the quarry.

4.4.2 Femme Osage Slough and Creeks

Surface water and sediment samples from the upper and lower reaches of the Femme Osage Slough, Little Femme Osage Creek, and downstream portion of Femme Osage Creek have been characterized for radiological and chemical contamination. Contaminants identified as contaminants of potential concern (COPCs) for surface water and sediment included several metals and uranium (see Table 1). Nitroaromatic compounds were also identified as COPCs for surface water, but were only detected at low concentrations in the Little Femme Osage Creek upgradient of the quarry. The source of this contamination is believed to be runoff from the Weldon Springs Ordnance Works (WSOW) area. In general contaminant concentrations were lower in the creek than in the slough. Plausible sources of contamination in the slough include groundwater seepage, runoff from Vicinity Property 9 prior to remediation, and mixing with Missouri River water. Several metals that were elevated in the creek and slough were also elevated in the Missouri River.

Fish from Femme Osage Slough were collected and analyzed to investigate any potential impacts from site contaminants. Species sampled from the slough included white and black crappie, largemouth bass, sunfish, and several bottom feeders such as bigmouth buffalo, yellow bullhead, and common carp. Fish samples were analyzed for uranium, radium, thorium, arsenic, lead, and mercury. Samples were prepared as fillets, fish cakes, and whole body samples. Analyses indicated low-level concentrations of metals (i.e., lead, arsenic, and mercury) and uranium, similar to concentrations detected in the background samples collected from Busch Lakes 33 and 37. Radium and thorium isotopes were not detected in any samples.

### 4.4.3 Groundwater

Contamination of groundwater underlying the quarry area has been characterized from data collected from a network of monitoring wells. This network includes 19 wells that monitor groundwater in the bedrock system and 26 wells that monitor groundwater in the alluvium. Four additional alluvium wells are owned by St. Charles County (see Figure 4). Data over a 10-year period were evaluated in determining the nature and extent of contamination. The primary contaminants in quarry groundwater north of the slough are uranium and nitroaromatic compounds. These contaminants were likely derived from contaminated bulk wastes that were previously disposed of in the quarry. Although other contaminants were present in quarry bulk wastes, uranium and

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nitroaromatic compounds are more soluble and were leached from the bulk wastes into the shallow groundwater.

The extent of the uranium contamination is limited to the area north of the slough. The highest concentrations of uranium were detected in wells along the southern rim of the quarry and southward in the alluvium near Vicinity Property 9. South of the slough, slightly elevated uranium levels with respect to the statistically determined background value (i.e., 2.8 pCi/L) were detected at RMW-2. However, the maximum uranium concentration detected at RMW-2 (i.e., 10 pCi/L) is within the range of concentrations detected in the background wells. Uranium concentrations in the remaining wells south of the slough have been in the background range.

Prior to removal of the bulk wastes from the quarry, nitroaromatic compounds were also detected at concentrations greater than 1 µg/L in four shallow bedrock wells and two alluvial wells located north of the slough. Between 1996 and 1997, a 40% reduction in TNT and an 18% reduction in DNT concentrations have been observed.





# 5 SUMMARY OF SITE RISKS

Potential impacts to humans, biota, and other environmental resources that might occur at the quarry area if no remedial action is conducted were assessed as part of the process for selecting an appropriate remedial action. Current and future land use conditions were considered in the assessment presented in the Baseline Risk Assessment report (DOE 1998a) prepared for the QROU. Key results of the human health and ecological assessment are summarized in Sections 5.1 and 5.2.

## 5.1 HUMAN HEALTH

Potential carcinogenic risks for both radiological and chemical exposures were assessed in terms of the increased probability that an individual would develop cancer over a lifetime. The U.S. Environmental Protection Agency (EPA) has indicated that for known or suspected carcinogens, the acceptable exposure levels for the general public at sites on the NPL are generally concentrations that represent an excess upper-bound lifetime cancer risk to an individual of between 1 x 10 -6 and

1 x 10 -4 (i.e., 1 in 1,000,000 to 1 in 10,000 [EPA 1989]). This "acceptable range" is used as a point of reference for discussing the results of the carcinogenic risk assessment for the QROU.

Potential health effects other than cancer from exposure to chemical contaminants were also assessed. The quantitative measure of noncarcinogenic health effects is the hazard index. The EPA has defined a hazard index of greater than 1 as the level of concern for noncarcinogenic health effects.

A recreational visitor scenario was used to project human exposures to contaminants identified in the RI for the quarry area (DOE 1998d) on the basis of current and assumed future land uses. This scenario is consistent with current land use at the quarry area (primarily north of the slough and the slough itself); future land use is expected to remain similar to current use. Groundwater is used for residential purposes at the county well field; however, monitoring data indicate that concentrations at the county well field are consistent with background, and this is not expected to change in the future.

In this case, reasonable maximum exposure is not considered to include residential or other scenarios that include direct, long-term consumption of localized contaminated groundwater. Because of the localized nature of the contamination and physical constraints, such as low groundwater yields and unsustainable production of these low yields, the surficial nature of the groundwater, and the location of the area within the Missouri River floodplain, which makes the area susceptible to routine flooding, such scenarios are not considered plausible.



Exposure pathways and associated risk estimates evaluated for the quarry proper and Femme Osage Slough and nearby creeks are summarized in Table 2. Exposure pathways evaluated for the quarry proper included external irradiation, incidental ingestion and dermal contact with soil, inhalation of air particulates, and ingestion of surface water from the quarry pond. Exposure pathways evaluated for the slough and creeks included ingestion of surface water, sediment, and fish; dermal contact with surface water and sediment; and inhalation of air particulates. The recreational visitor was assumed to visit each area for 4 hours, 20 times per year, over a period of 20 years.

The results of the risk calculations for the recreational visitor at the quarry proper and Femme Osage Slough indicate that radiological and chemical risks are below to within the EPA's acceptable risk range of 1 X 10 -6 to 1 x 10 -4 (EPA 1989). Hazard indices are also less than 1, which indicates that noncarcinogenic health effects are not a concern. The estimated radiological risk

is
3 x 10 -5 for the recreational visitor exposed to contaminants at the various locations (i.e., cumulative
risk from exposure to contaminants at the quarry proper and at Femme Osage Slough and creeks); this estimate incorporates multiple contaminants, multiple media, and multiple pathways. The estimated chemical carcinogenic risk and hazard index for this recreational visitor are 4 x 10 -6 and
0.05, respectively.

The estimated risks are within the acceptable risk range and do not indicate the need for
further remediation of the quarry proper, the Femme Osage Slough and nearby creeks, or the quarry
groundwater north of the Femme Osage Slough.

The available hydrological and geochemical information, as well as long-term environmental monitoring data, support the conclusion that site contaminants will not measurably affect the Missouri River alluvial aquifer. However, given the reliance on natural systems to preclude
potential significant impacts to the aquifer, alternatives addressing groundwater remediation were
evaluated in the FS (DOE 1998b).

## 5.2 ECOLOGICAL ASSESSMENT

Femme Osage Slough and Little Femme Osage Creek are the principal habitats at the QROU where biota could be exposed to quarry-related contaminants. A screening level assessment employing very conservative exposure scenarios was conducted for these habitats. This assessment identified current levels of aluminum, barium, manganese, and uranium in the surface water of Femme Osage Slough and Little Femme Osage Creek as posing a potential risk to aquatic biota using
these habitats. Risk estimates or quotients for these contaminants were greater than 1, indicating the
potential for risk and a need for further ecological evaluations of the aquatic habitats in the slough
and creek. These ecological evaluations were conducted, and the results are discussed below. For other contaminants in surface water at the quarry area, no or low risks were identified. Arsenic,



TABLE 2 Summary of Human Health Risk Estimates for the Quarry Area

| Pathways (Recreational Visitor) | Radiological Carcinogenic Risk | Chemical Hazard Index | Chemical Carcinogenic Risk |
|---|---|---|---|
| Quarry proper | | | |
| Soil | | | |

| | | | | |
|---|---|---|---|---|
| External irradiation | 1 x 10 -5 | NA a | NA | |
| Ingestion | 4 x 10 -7 | 0.004 | 1 x 10 -7 | |
| Dermal | 1 x 10 -1 | 0.0009 | 1 x 10 -8 | |
| Inhalation | 2 x 10 -9 | < 0.000 1 | 1 x 10 -12 | |
| Fractures b | | | | |
| External irradiation | 3 x 10 -5 | NA | NA | |
| Ingestion | 7 x 10 -7 | 0.008 | 6 x 10 -8 | |
| Inhalation | 4 x 10 -9 | <0.0001 | 7 x 10 -13 | |
| Femme Osage Slough c | | | | |
| Surface water | | | | |
| Ingestion | 3 x 10 -7 | 0.003 | 9 x 10 -7 | |
| Dermal | 7 x 10 -9 | <0.0001 | 2 x 10 -8 | |
| Sediment | | | | |
| Ingestion | 3 x 10 -8 | 0.006 | 2 x 10 -7 | |
| Dermal | 1 x 10 -10 | 0.001 | 4 x 10 -9 | |
| Inhalation | 1 x 10 -10 | <0.0001 | 1 x 10 -13 | |
| Fish | | | | |
| Ingestion | 8 x 10 -9 | 0.03 | 3 x 10 -6 | |
| Total d,e,f | 3 x 10 -5 | 0.05 | 4 x 10 -6 | |
| Overall carcinogenic risk g | 3 x 10 -5 | | | |

a NA = not applicable.
b Dermal contact with soils in the fractures is assumed to be unlikely.
c Estimates for Femme Osage Slough are representative of those for Little Femme Osage and Femme Osage Creeks.
d These totals represent risks and the hazard index for the multiple pathways exposure scenario, which projects a recreational visitor who is exposed to contaminants present at the quarry area (including at the quarry proper and Femme Osage Slough).
e Ineestion of groundwater is unlikely because there is no access for a recreational visitor to the quarry groundwater. However, calculations were performed for potential risk to a hypothetical resident from ingestion of and dermal contact with groundwater (see Section 5.2.3 of the BRA [DOE 1998a)) for informational purposes only.
f External irradiation for quarry proper soil and fractures was not summed because it is not appropriate to do so; the higher of the two risks was used to calculate the total.

g The sum of chemical and radiological carcinogenic risks rounded to one significant figure.



cadmium, lead, manganese, mercury, nickel, and zinc are present in sediments at concentrations estimated to result in low risk to aquatic biota. No risks from nitroaromatic compounds were indicated in either surface water or sediment. Modelina results indicated no risks to modeled terrestrial wildlife receptors foraging in Femme Osage Slough or drinking from Little Femme Osage Creek.

Because screening risk estimates for several metals indicated potential risks, as discussed above, further ecological evaluations or surveys of aquatic and terrestrial biota were conducted at the quarry area to further evaluate actual impacts. The survey results indicate that the existing aquatic and terrestrial communities consist of species that would be expected to occur in the area. No impacts to abundance or species diversity of aquatic invertebrates were detected. Internal and external examinations of small mammals collected from the site showed no abnormalities that might indicate adverse effects from exposure to site contaminants. Analyses of tissue from fish and small mammals indicated uranium concentrations within the range reported in the literature for North America for which no adverse effects have been observed. Concentrations of radionuclides in the tissues of small mammals collected from the quarry area were comparable to levels detected in specimens from reference sites.

In summary, the current levels of contamination in surface water and sediments from Femme Osage Slough and Little Femme Osage Creek do not appear to be affecting ecological resources at these habitats and do not pose a future risk to biota at the site. This conclusion is supported by the absence of any observable adverse effects to aquatic or terrestrial biota, the generally low levels of potential risk estimated for aquatic biota, and the lack of risks estimated for terrestrial biota. Thus, remediation of these habitats is not indicated on the basis of potential ecological concerns.



# 6 DESCRIPTION OF REMEDIAL ALTERNATIVES

Six preliminary alternatives for addressing groundwater contamination were assembled from combinations of technologies and associated management strategies that were retained following, a screening and evaluation process. Potential remedial action alternatives were screened

to eliminate those alternatives determined too difficult to implement on the basis of unproven technologies, those determined not sufficient to remediate the site within a reasonable time period, or those determined to have limited application for specific contaminant or site conditions. Details of these evaluations are presented in the Feasibility Study report (DOE 1998b) prepared for the QROU. The three final alternatives retained for detailed analysis are described in Sections 6.1 to 6.3.

## 6.1 ALTERNATIVE 1: NO ACTION

Under Alternative 1, no further action would be taken at the QROU, CERCLA requires consideration of a "No Action" alternative. No containment, removal, treatment, or other mitigative measures would be implemented. This alternative does not include groundwater monitoring or any active or passive institutional controls (e.g., physical barriers, deed restrictions). Under this alternative, it was assumed that all existing activities, including monitoring by DOE, would be discontinued. Existing land use and natural conditions and processes are expected to continue and provide continued protection to the downgradient well field. However, this alternative does not provide for the collection of data that would verify the continued protectiveness of future conditions.

No cost is associated with the performance of this alternative. No net present worth, capital costs, or annual operation and maintenance (O&M) costs are associated because no activities would be undertaken.

## 6.2 ALTERNATIVE 2: MONITORING WITH NO ACTIVE REMEDIATION

Under Alternative 2, long-term monitoring of groundwater in the quarry area would be performed; results would be evaluated at five-year review periods as required by CERCLA. Contaminant concentrations in the groundwater north of Femme Osage Slough are expected to decrease with time as a result of (1) adsorption of uranium onto the fine-grained aquifer materials and (2) precipitation., in the area of the slough where decaying organic matter maintains a reducing condition. These reducing conditions convert uranium to the +4 state, thus forming uranium dioxide UO 2), which is highly insoluble. Continued migration of very small concentrations of uranium in the groundwater to the St. Charles County well field is probable; however, concentrations greater than the background range have not been detected. In addition, concentrations are not expected to increase because of the removal of the bulk waste source materials. Monitoring data collected for

the past 10 years from wells south of the slough and at the production wells have indicated uranium concentrations to be consistent with the statistically derived background level of approximately 2.8 pCi/L. Contaminated groundwater migrating south of the slough would be significantly diluted with uncontaminated water from the Missouri River. Groundwater originating from the quarry area contributes less than 1% of the groundwater available to the production wells. Infiltration from rainwater, runoff, and sporadic local flooding, could also dilute the groundwater at the quarry area north of the slough (DOE 1998d).

Groundwater monitoring would be conducted in the existing well network, as appropriate. This network would be expanded or reduced, depending on the results of future efforts to optimize the network for long-term monitoring. Optimization efforts would evaluate contaminant distribution, groundwater flow paths, and geochemical constraints that govern contaminant fate and transport in the aquifer system. The network of wells to be monitored as part of this alternative would be formulated from the existing network to include monitoring of the area west of RMW-2. The exact monitoring network and details regarding frequency of sampling and parameters analyzed would be identified in subsequent remedial design/remedial action (RD/RA) reports for the QROU.

Under Alternative 2, the monitoring response would continue in perpetuity or until judged unnecessary based on a review of the data. A judgment to discontinue monitoring would be developed in consultation with the EPA and the Missouri Department of Natural Resources. Because contamination would remain on-site above levels that allow for unlimited use and unrestricted exposure, reviews would be conducted at least every five years to ensure that the remedy continued to provide adequate protection of human health and the environment.

Costs for this alternative would be associated with performing periodic monitoring of an optimized monitoring network to provide data for verifying that conditions in the quarry area and the well field remain protective of human health and the environment. Routine sampling and analysis of uranium and nitroaromatic compound concentrations would be performed, as well as data collection to verify the continued effects of natural processes on contaminant concentrations within the area.

The annual O&M cost for the monitoring effort is estimated to be no greater than $0.6 million. This estimate is an upper bound because the sampling, frequency and number of wells assumed were based on the current network and frequency of sampling. The final monitoring network is expected to be smaller and would be sampled at a lower frequency. The capital cost for this alternative is estimated to be approximately $0.15 million for the construction of up to seven additional groundwater monitoring wells.

## 6.3 ALTERNATIVE 6: GROUNDWATER REMOVAL AT SELECTED AREAS, WITH ON-SITE TREATMENT

Under Alternative 6, an interceptor trench would be installed north of the Femme Osage Slough in a selected area bounded by and encompassing monitoring wells MW-1014 and MW-1016 (approximately 340 m [1,100 ft]). This trench would be installed in the unconsolidated materials to the top of bedrock. The purpose of the trench would be to create a high-permeability channel through the native soil so that more groundwater could be recovered. Extracted groundwater would be treated, as necessary, to meet discharge limits.

Groundwater modeling using, analytical methods indicates that the effect of the extraction system may reduce the mass of uranium within the alluvial aquifer by 8 to 10% over a two-year operating period (see Figure 5). This constitutes a relatively small reduction and does not provide a measurable increase in protectiveness over the foreseeable future.

The capital cost is estimated to be between $1 and $2 million for construction of the interceptor trench. The O&M costs for a two-year testing period are estimated to be between $1 and $2 million. The O&M costs are primarily for treatment of the extracted groundwater (which ranges from $0.4 to $0.5 million per year), if treatment is necessary to meet discharge limits.

The costs associated with the long-term monitoring portion of this alternative would be identical to those discussed in Section 6.2. The monitoring approach for this alternative would not be significantly different from that designed for Alternative 2: Monitoring With No Active Remediation.

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# 7 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparison of the final remedial action alternatives for the QROU was conducted by categorizing the nine evaluation criteria of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (EPA 1990) into the following three groups: threshold criteria, primary balancing criteria, and modifying criteria.

The threshold category contains the two criteria that each alternative must meet in order to be eligible for selection:

- Overall protection of human health and the environment; and

- Compliance with applicable or relevant and appropriate requirements (ARARs), unless a waiver condition applies.

These threshold criteria ensure that the remedial action selected will be protective of human health and the environment, and that the action will either attain the ARARs identified at the time of the ROD or provide grounds for obtaining a waiver.

The primary balancing category contains the five criteria that are used to assess the relative advantages and disadvantages of each alternative to determine which is most appropriate:

- Long-term effectiveness and permanence;

- Reduction of toxicity, mobility, or volume through treatment;

- Short-term effectiveness;

- Implementability; and

- Cost.

The first two criteria consider the preference for treatment as a principal element and the bias against off-site land disposal of untreated waste. Cost-effectiveness is determined by evaluating the following three of the five balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility, or, volume through treatment; and short-term effectiveness. Overall effectiveness is then compared with cost to ensure that the costs are proportional to the overall effectiveness of a remedial action.



The modifying, category consists of two criteria that are considered in remedy selection and that are addressed in the responsiveness summary (see Appendix A) of this ROD:

- State acceptance and

- Community acceptance.

Table 3 summarizes the analysis performed for the first seven criteria.

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TABLE 3 Comparative Analysis of Alternatives

| Evaluation Criteria | Alternative 1: No Action | Alternative 2: Groundwater Removal at Selected Areas with On-Site Treatment | Alternative 6: Monitoring with No Active Remediation |
|---|---|---|---|
| Overall protection of human health and the environment | Would be protective of human health and the environment in both the short and long term. | Would provide protection similar to Alternatives 1 and 2. Has alternative would remove and treat a contaminated volume of groundwater would lead to a slight reduction in the amount of uranium that could potentially migrate south of the slough toward the St. Charles County well field. However,the additional slight reduction would not result in greater protectiveness than Alternatives 1 and 2. This alternative would also provide for monitoring. | Would provide protection similar to Alternatives 1 and 6. Monitoring data would be collected to verify that conditions continue to be protective of human health and the environment |
| Compliance with ARARs | Complies with ARARs. | Complies with ARARs. | Complies with ARARs. |
| Long-term effectiveness and permanence | Future conditions are expected to be at least similar to current, if not better. Continued slow decreases in contaminant concentrations are expected as a result of source removal and naturally occurring processes. | Would be similar if not slightly better than that of Alternatives 1 and 2 because of the reduction in the amount of uranium that could potentially migrate south of the Femmie Osage Slough toward the St. Charles County well field. However, the additional slight reduction would not result in greater protectiveness than Alternatives 1 and 2. | Similar to Alternative 1. In addition, data would be available to verify that conditions at the quarry area continue to be protective of human health and the environment. |
| Reduction of toxicity, | No immediate reduction of toxicity. | Would satisfy the statutory preference for | Same as for Alternative 1. |

| | | | |
|---|---|---|---|
| | | | treatment as a principal |
| mobility, or volume | | mobility, or volume because no | |
| element of remediation and would provide reduction in the | | | |
| through treatment | | treatment would be performed | |
| toxicity, mobility, or volume of a small portion of the | | | |
| | | However, slow reduction of | |
| contaminated groundwater through treatment. The effects of the | | | |
| | | contaminant concentrations is expected | |
| extraction system may reduce the mass of uranium within the | | | |
| | | as a result of natural processes | |
| alluvial aquifer by 8 to 10% relative to the baseline (no action). | | | |
| | | | |
| Short-term effectiveness | No potential impacts on workers or the | | Expected to be low, |
| with less than one case of | | Similar to Alternative 2. Expected to | be low, with less |
| than two | | | |
| | environment, because no activities | | occupational injury |
| and no occupational fatalities | | cases of occupational injury and no occupational | |
| fatalities during | | | |
| | would be undertaken. | | during proposed |
| monitoring well construction. | | proposed construction activities. | |
| | | | Any potential |
| short-term environmental impacts | | | |
| | | | would be limited to |
| the immediate vicinity of the | | | |
| | | | quarry area, and |
| mitigative measures would be | | | |
| | | | applied to minimize |
| potential impacts | | | |



TABLE 3 (Cont.)

| Evaluation Criterion | Alternative 1: No Action | Alternative 2: Groundwater Removal at Selected Areas, with On-Sile Treatment | Alternative 6. Monitoring with No Active Remediation |
|---|---|---|---|
| Implementability | No implementability concerns because no action would be taken. Monitoring would be readily available | Few implementability concerns. Groundwater extraction and treatment are well-developed technologies. Further development of these technologies would not be required | Few implementability concerns because of the limited actions taken. performed with the use of resources. |
| Cost | No cost is expected to be associated with this alternative. | Not cost-effective compared with Alternatives 1 and 2, because the expenditure of funds for removal of a minimal amount of | Is cost-effective because it would provide overall protection of human health and the environment for a reasonable cost. |

Costs are associated with environmental monitoring construction and operation of wells, and conducting a least every five years. existing resources relatively low cost.

contamination would not be cost effective. continuing the existing program, potential additional monitoring performance review at Could be implemented with and maintained at a



## 8 SELECTED ACTION

DOE's selected action for the QROU is Alternative 2: Long-Term Monitoring. This decision was based on the requirements of CERCLA, the detailed analysis of alternatives using the nine NCP criteria, and input received during the public comment period. The selected action will ensure continued protection of groundwater resources within the St. Charles County well field over the long term.

On the basis of the exposure assessment discussed in Section 5, no further remediation is necessary to protect human health and the environment. Because source removal was accomplished under a previous action, no new migration of contaminants to the groundwater system should occur. However, because of the presence of significant levels of uranium in quarry groundwater north of the slough, which is in close proximity to the St. Charles County well field, it was considered prudent to continue to evaluate the need for and effectiveness of reducing or removing the uranium from quarry groundwater and to confirm the behavior of natural processes occurring at the quarry area. These natural processes are expected to mitigate any potential migration of the uranium toward the well field.

The FS evaluations (DOE 1998b) indicate that available engineering technologies could achieve only a very small and slow reduction of the uranium in quarry groundwater at high costs without achieving increased protection. Accordingly, the selected action for the QROU has the following components that the DOE will implement:

1. A long-term groundwater monitoring strategy will be implemented to confirm expectations that significant impacts to the Missouri River alluvial aquifer will not occur and that conditions at the quarry area will continue to be protective of human health and the environment.

2. Institutional controls will be necessary to prevent uses inconsistent with recreational use, or uses that would adversely affect contaminant migration. DOE will continue to coordinate with the Missouri Department of

Conservation and the Missouri Department of Natural Resources-Parks to establish a written agreement, such as a license agreement, memorandum of understanding, or deed attachment, outlining and agreeing to the terms of the institutional controls. Terms may include limiting access to groundwater north of the slough for the following uses: irrigation, consumption, or as a surface water source. The terms of the agreement will be evaluated at each five-year review, at which time changes or deletions to the terms would be made, as appropriate. The Well Field Contingency Plan (DOE 1998e) provides for ongoing availability of a safe water supply.



3. The quarry will be restored through backfilling with soil to reduce fall hazards, stabilize the highwalls, eliminate ponding of surface water, and minimize infiltration through the inner quarry area to the groundwater.

In addition, further data collection will be performed by DOE to support ongoing evaluations regarding the need for and effectiveness of groundwater remediation. This activity will include a pilot study involving the construction of a trench. Soil sampling at the quarry proper will also be conducted to delineate the full extent of radiological contamination at the northeast slope and ditch area within the quarry proper.

## 8.1 QUARRY GROUNDWATER MONITORING

The selected action addresses groundwater contamination by monitoring to provide data for verifying that conditions in the quarry area and the well field remain protective of human health and the environment. These data will also indicate the continued effects of natural processes on contaminant concentrations within the area. Routine sampling and analysis of uranium and nitraromatic compound concentrations in groundwater will be performed. It is anticipated that existing patterns of contaminant migration will persist over time. However, if long-term monitoring identifies a trend or change resulting in increased levels of contaminants south of the slough approaching a trigger level of 30 pCi/L, the potential for significant impacts to the well field and the alluvial aquifer will be reevaluated. This reevaluation will include a risk evaluation consistent with CERCLA, identification of ARARs, and a determination of need of any groundwater remediation. The trigger level of 30 pCi/L is sufficiently above the established natural variation (nondetect to 16 pCi/L) of uranium in the aquifer to be a useful indicator of currently unanticipated migration from the site. In addition, this level is considered protective under hypothetical exposure assessments and is consistent with the standard in Title 40, Part 192.02, of the Code of Federal Regulations (40 CFR 192.02).

Remedial design activities will define an optimal monitoring network, identify

appropriate frequencies and parameters for monitoring, and provide for interpretations of the results that will determine the criteria for continuation or ultimate conclusion of monitoring activities as part of the QROU ROD. The decision to continue or conclude monitoring activities will be made at the initial five-year review period and during each subsequent five-year review, as appropriate.

To optimize logistics, monitoring activities stipulated in this ROD may be correlated with those for the Well Field Contingency Plan (DOE 1998e). The option to combine these two monitoring requirements will also be evaluated before initiation of monitoring activities for this ROD.



A network of wells to be monitored as part of the action in this ROD will be designed to provide for long-term monitoring of groundwater, including the groundwater in the area west of RMW-2. The final design of the optimized network will be presented in the RD/RA reports. Existing wells that are likely to be included in the post-ROD monitoring network are shown in Figure 6. These wells were selected on the basis of the following preliminary selection criteria; distribution of contamination; the hydrological, geochemical, and contaminant fate and transport models; and the location and screening interval of each well. This preliminary network includes existing wells located north of the slough that would monitor changes in the horizontal and vertical distribution of contaminants. On the basis of the hydrological conceptual model depicting groundwater flow from the north of the slough to the south of the slough, existing wells that monitor groundwater along the base of the alluvium could also be selected and included in the monitoring network. The existing RMW wells will also be included to monitor the portion of the alluvial aquifer that supplies the well field.

## 8.2 QUARRY PROPER RESTORATION

The current restoration design plan includes backfilling the quarry with soil to reduce fall hazards, to stabilize the north and south highwalls, and to eliminate ponding of surface water. The floor and benches of the quarry would be covered by the backfill. The backfill would reduce the potential for mobilization of any potential residual contaminants into the groundwater. Restoration would be designed to force groundwater flow around the inner quarry area by backfilling with a relatively low permeability material. Infiltration would be reduced throuch the installation of a low

permeability cover. More definitive specifications for the backfill would be included in subsequent RD/RA reports.

The design would also effectively prevent any potential residual contaminants in the cracks and fissures (i.e., flakes of yellowcake) from mobilizing to the surface through erosion and/or freeze/thaw action, thus reducing the already low potential risks associated with external gamma radiation and ingestion. Mobilization of contaminants into the groundwater would not be likely because the benches are in the unsaturated portions of the bedrock, and infiltration of precipitation would be prevented by the final grading designed to promote sheetflow and to return the area to conditions that are as close as possible to natural contours. Dismantlement of facilities utilized during bulk waste removal activities would also be performed during this time. Haul road restoration is expected to be minimal. Restoration activities are currently planned for the fall of 1999.

## 8.3 WELL FIELD CONTINGENCY PLAN

The Well Field Contingency Plan (DOE 1998e) was developed by DOE to ensure the continued availability of a safe and reliable public water supply for St. Charles County during bulk

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waste removal activities. This plan provides for groundwater monitoring to detect any contaminant miqration beyond the presently known boundaries, defines action levels, and identifies response actions that could be taken in the unlikely event of elevated contaminant levels at the well field. To date, no impacts to the well field have been observed. and none are expected in the future. The Well Field Contingency Plan (DOE 1998e) also discusses the preparation of hydrogeological characterization plans to support development of criteria for the design and construction of a replacement well field in the unlikely event that should prove necessary.

In developing the approach contained in the Well Field Contingency Plan (DOE 1998e), data from south of the slough were evaluated to identify trends or changes indicative of impacts to the Missouri River alluvium from the quarry. The level adapted as a trigger for reevaluation of the conditions in the Missouri River alluvium has been established at 30 pCi/L in a RMW-series well. Should such a level occur, DOE would initiate a more rigorous monitoring effort to investigate the cause and source of this impact. On the basis of conservative modeling performed in this portion of the aquifer, impacts to the production wells would not occur within the 100-year modeling period

if levels of 30 pCi/L were indicated in a RMW-series well.

## 8.4 ADDITIONAL DATA NEEDS

DOE will conduct further data collection for two purposes: (1) to gather data to continue the evaluation to determine the effectiveness of groundwater remediation and (2) to define the extent of radiological soil contamination at the northeast slope and ditch area at the quarry proper.

### 8.4.1 Field Test

Given the presence of significant levels of uranium in quarry groundwater north of the slough, which is in close proximity to the St. Charles County well field, and the reliance on the natural systems to limit potential exposure, evaluation to determine the effectiveness of groundwater remediation will be continued, and field data related to uranium recovery in quarry groundwater will be collected. This field test, conducted to verify predictive models that were presented in the FS (DOE 1998b) relating to groundwater remediation, will be essentially a scaled down version of the approach evaluated under Alternative 6. Alternative 6 is considered to be the most effective approach to groundwater extraction. Groundwater removal will be facilitated with the use of a trench sufficiently large to intercept a representative cross section of alluvial material and optimally located to extract groundwater in areas with high uranium contamination. The system will be evaluated and monitored for up to two years, and the data collected will be compared with a set of predetermined performance goals. These performance goals will be identified on the basis of the predictive model shown in Figure 5. This predictive model indicates that this trench could only reduce the uranium mass by no more than 10% for the two-year operational period. The evaluations in the FS also



indicate that the time frame for remediation of uranium-contaminated groundwater north of the slough would be greater than 100 years. If performance of the trench system exceeds the performance goals, the need for and effectiveness of groundwater remediation will be reevaluated. Conversely, if the performance of the removal system is less effective or within the specified performance goals, further evaluation of groundwater will not be necessary. The determination of the performance goals for the removal system and details pertaining to structure, size, location, and sampling parameters

will be presented in the RD/RA work plan developed in consultation with the EPA and the Missouri Department of Natural Resources.

The determination of the effectiveness of active groundwater remediation will include consideration of factors consistent with those presented in Office of Solid Waste and Emergency Response (OSWER) Directive 9234.2-25, "Guidance for Evaluating the Technical Impracticability of Groundwater Restoration."

Field tests will be conducted in the marginal alluvium north of the slough to provide site-specific estimates for parameters (i.e., hydraulic conductivity, distribution coefficients, and oxidation potential) that demonstrate the engineering feasibility and reliability of groundwater remediation in the area of uranium impact. These tests will also ascertain the variability of these parameters because of the heterogeneity of the aquifer materials. This information will be used to supplement the present hydrological, geochemical, and contaminant fate and transport models for the quarry area north of the slough for evaluating the need for and effectiveness of groundwater remediation.

Data have been previously compiled that indicate the distribution of uranium and fate and transport mechanisms in the aquifer system both north and south of the slough (see Chapter 4). These data indicate that the hydrogeologic and geochernical systems in the quarry area are complex and result in a system with a limited capability of effectively remediating groundwater.

### 8.4.2 Soil Sampling at the Northeast Slope and Ditch Area

At the quarry proper, additional sampling is planned at the northeast slope and the ditch area near the transfer station (see Figure 7). Only a few samples were collected from these two areas during the RI phase because access was difficult. The samples collected indicate the presence of radiological contamination; however, additional samples need to be collected to sufficiently define the extent of contamination. Risk calculations will be performed consistent with the approach presented in the Baseline Risk Assessment report (DOE 1998a), to include these additional data points. If response action is necessary, the cleanup criteria for radionuclides presented in the chemical plant ROD (DOE 1993) will be applied. This response action would involve removal of contaminated soil from the northeast slope and the ditch area. Finally, DOE intends for the extent of any soil removal at the northeast slope to be protective of human health and the environment, but not to include the relocation of State Route 94.

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# 9 STATUTORY DETERMIINATIONS

In accordance with the statutory requirements of Section 121 of CERCLA, as amended, remedial actions shall be selected that:

- Are protective of human health and the environment.
- Comply with ARARs;
- Are cost-effective; and
- Utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

The selected action is discussed below in relation to how it fulfills the requirements. In addition, CERCLA Section 121's preference for treatment as a principal element is discussed.

## 9.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected action will be protective of human health and the environment. Because source removal has been accomplished under a previous action, no new migration of contaminants to the groundwater system should occur. Long-term monitoring will be used to confirm expectations that uranium located between the quarry and the Femme Osage Slough will not significantly affect the Missouri River alluvial aquifer or the St. Charles County well field.

## 9.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A comprehensive list of potential chemical- and action-specific ARARs and to-be considered requirements (TBCs) for the selected action are presented in Appendix A of the FS (DOE 1998b). The listed ARARs were identified according to the NCP and procedures outlined in the most recent EPA guidance. The selected action would comply with the following ARARs, as required by Section 121(d) of CERCLA.



### 9.2.1 Chemical-Specific ARARs

Chemical ARARs set concentration limits or ranges in various environmental media for

specific hazardous substances, pollutants, or contaminants of concern. Missouri water quality standards in groundwater for nitrobenzene (17 µg/L),2,4-dinitrotoluene (2,4-DNT)(0.11 µ/L), and 1,3-dinitrobenzene (1,3-DNB)(1.0µg/L) are chemical-specific ARARs for quarry groundwater. The limit for 1,3-DNB is a health advisory level that is used to establish a groundwater cleanup criterion until additional data become available to support alternative criteria or until other standards are established.

Currently, only a few data points marginally exceed the Missouri water quality standards for groundwater. It is projected that these ARARs are likely to be met within a reasonable period of time (i.e., several years) after implementation of the selected action for this ROD (see Section 8). Appropriate action will be taken either to meet or obtain a waiver of the ARARs in the event the selected action fails to meet them. However, at this time it is expected that the selected action will meet ARARs.

The FS (DOE 1998b) and the PP (DOE 1998c) considered whether the 40 CFR 192.02 standard for uranium is a potential ARAR for this action. The quarry groundwater north of the slough is impacted; however, it is not considered to be a usable groundwater source. Conversely, the Missouri River alluvium south of the slough, which includes the well field, is currently not impacted and is presently being used as a potable water source. Because quarry groundwater north of the slough is not a usable source, 40 CFR 192.02 is not considered an ARAR for that groundwater. However, 40 CFR 192.02 would likely be an ARAR for any remedial action considered for the usable groundwater source south of the slough in the unlikely event of contaminant migration from north of the slough. While 40 CFR 192.02 currently appears to be the only groundwater standard that would be considered as a potential ARAR for any future remedial action to address contamination of usable groundwater, other standards in place at the time of the future action would also be considered in the ARAR analysis.

### 9.2.2 Chemical-Specific TBCs

The proposed maximum contaminant level (MCL) of 20 µg/L for uranium identified in the Proposed National Primary Drinking Water Regulations (Volume 56, page 33050, of the Federal Register [56 FR 33050] [July 18, 1991]) is treated as a TBC because it does, not meet the requirements to be considered an ARAR (20 µg/L for uranium corresponds to 13.6 pCi/L for the distribution of uranium isotopes present in groundwater at the quarry area.). This standard is not an ARAR because it is a proposed regulation and is not promulgated. Section 121 (d) of CERCLA does not require compliance with TBCs. Although TBC, the proposed MCL is not useful for evaluating groundwater impact at this site, because it falls within the range of natural background

concentrations of uranium in groundwater in this area. A more appropriate level of 30 pCi/L has been selected as a trigger level for reevaluating the decisions made regarding the QROU. The trigger level of 30 pCi/L total uranium is considered to be sufficiently above the natural variation of uranium in the aquifer to be indicative of site impact and is a level considered to be protective under hypothetical exposure assessment.

### 9.2.3 Action-Specific ARARs

Action-specific ARARs are standards that restrict or control specific remedial activities related to the management of hazardous substances or pollutants for a variety of media. These requirements are triggered by a particular activity, not by specific chemicals or the location of the activity. Several action-specific ARARs may exist for any specific action. These action-specific ARARs do not in themselves determine the appropriate remedial alternative, but indicate performance levels to be achieved for the activities performed under the selected action. On-site actions must comply, with all substantive provisions of an ARAR, but not with related administrative and procedural requirements (e.g., filing reports or obtaining a permit). The term "on-site" includes the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary to implement the response action. No permit applications would be necessary for any on-site activities. The selected action would comply with all pertinent action-specific ARARs, which are listed in Appendix A of the FS (DOE 1998b) and summarized below.

All activities that may result in the disturbance of media contaminated with radionuclides (e.g., well construction) would conform to the operational standards for uranium and thorium mill tailings promulgated by the EPA (Title 40, Part 192, Subparts D and E of the Code of Federal Regulations [40 CFR 192, Subparts D and E]) that establish certain annual dose limitations for exposure to radiation. Although not applicable to Weldon Spring site activities, these requirements are relevant and appropriate to these activities because they specifically address exposures of workers to radiation associated with the same radionuclides during remediation activities. Similarly, radiation exposure limits for the public established in Missouri Radiation Regulations, Protection Against Ionizing Radiation (Title 19, Part 20-10.040, et al., of the Code of State Regulations [19 CSR 20-10.040, et al.]), as they apply to nonoccupational exposures, are ARARs with which the selected action will comply.

A National Pollutant Discharge Elimination System (NPDES) permit for construction or operation (including discharge) of a water treatment facility is not required under Section 121 (e)(1) of CERCLA codified at 40 CFR 300.400 (e)(1). Use of an existing NPDES permitted facility is an option for groundwater treatment. Discharge contaminant concentrations will be consistent with

those of the existing facility.



In addition, any release of radionuclides to the ambient air during soil excavation activities will comply with the limitations set forth in the EPA's National Emission Standards for Hazardous Air Pollutants (40 CFR 61, Subpart H). Similarly, the release of particulate matter during other earth-disturbing activities must comply with Missouri Air Pollution Control Regulations (10 CSR 10-5.180 and 10-6.170). Missouri requirements for well construction would be an ARAR for any newly installed wells or for the plugging of wells under the selected action (10 CSR 23-4.050).

Appendix A of the FS (DOE 1998b) also lists several regulations that set occupational exposure limits for activities involving media contaminated with radionuclides, including the Missouri Radiation Regulations, Protection Against Ionizing Radiation (19 CSR 20-10.040 et al.); Occupational Safety and Health Administration (OSHA) Occupational Safety and Health and Environmental Controls (29 CFR 1910, Subpart G); and DOE Occupational Radiation Protection (10 CFR 835). These regulations are not ARARs because they are not environmental or siting regulations; however, as employee protection regulations, these requirements must be complied with by employees working with contaminated media or in contaminated areas.

DOE Order 5400.5, "Radiation Protection of the Public and the Environment," has been established as a TBC. Because DOE Orders are not promulgated regulations, they are not ARARs but are considered as TBCs. The selected action will comply with all DOE Orders.

## 9.3 COST-EFFECTIVENESS

The selected action would be cost-effective because it provides overall protection of human health and the environment at a reasonable cost. Costs are associated primarily with activities associated with long-term monitoring of groundwater (see Section 6.2).

The annual O&M cost for long-term monitoring is estimated to be no greater than $0.6 million. The capital cost is estimated to be approximately $0.15 million for potential construction of up to seven additional monitoring wells. Costs associated with the field tests and additional soil sampling would be identified in the RD/RA work plan. Preliminary estimates indicate that the cost for the additional field tests and additional soil sampling at the quarry proper would be approximately $0.4 million. Costs for construction of a trench are estimated to be between $1 and $2 million. The O&M costs for a two-year testing period are estimated to be between $1 and $2 million. The annual O&M costs would be primarily for treatment of extracted groundwater (which ranges from $0.4 to $0.5 million per year), if treatment is necessary to meet discharge limits.

## 9.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The selected action does not involve alternative treatment technologies, but it is expected to provide permanent protectiveness.

## 9.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

This remedy does not satisfy the statutory preference for treatment as a principal element. The selected action involves long-term monitoring. Treatment was not included because it was not a necessary element in achieving protectiveness.

## 9.6 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The implementation of the selected action would not result in permanent commitment of land at the quarry area. Current and future land use at the quarry area would not have to change as a result of the implementation of this action.

## 9.7 SIGNIFICANT CHANGES

The selected action differs from that of the preferred alternative presented in the Proposed Plan (DOE 1998c) in that it does not include the construction of a trench. The selected action calls for long-term monitoring to ensure protectiveness of human health and the environment. However, as part of additional sampling activities to be conducted by DOE, a pilot-scale study would be conducted involving construction of a trench to collect data that would support ongoing evaluations regarding the need for and effectiveness of groundwater remediation (see Section 8). This decision was reached after further discussions with the EPA and the Missouri Department of Natural Resources and in consideration of the overall concern for the effectiveness of the removal system. This concern was also expressed by the Weldon Spring Citizens Commission (WSCC).

## 10 REFERENCES

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APPENDIX A:

RESPONSIVENESS SUMMARY





APPENDIXA:

RESPONSIVENESS SUMMARY

The Proposed Plan (DOE 1998b) for the Quarry Residuals Operable Unit (QROU) was issued to the public for review and comment on March 18, 1998. The U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) held a public meeting to discuss the proposed action on April 16, 1998, at the Administration Building of the Weldon Spring Site Remedial Action Project (WSSRAP) located at 7295 Highway 94 South, St. Charles, Missouri. Representatives of the State of Missouri were also in attendance. The DOE and the EPA responded to oral comments made on the Proposed Plan (DOE 1998b) at this meeting; those responses are

included in the meeting transcript. The meeting transcript is part of the Administrative Record for the QROU and is on file at the information repositories for the WSSRAP. The repositories are located in the project office reading room at Francis Howell High School and at four branches of the St. Charles City/County Library as listed in Section 3 of this Record of Decision (ROD).

The public comment period for the Proposed Plan (DOE 1998b) was initially scheduled to end on April 18, 1998. However, the period was extended by 30 days to accommodate requests from the Weldon Spring Citizens Commission (WSCC) and the State of Missouri. The comment period formally ended on May 21, 1998. In addition to oral comments received and responded to at the public meeting, comment letters were received from the Missouri Department of Health (MDOH), the Missouri Department of Natural Resources (MDNR), and the WSCC. These letters are also part of the Administrative Record for the QROU. In this responsiveness summary, the comment letters are referred to by an alphabetical identifier determined by the order in which they were received by the project office. Each comment letter has been reproduced to provide detailed responses to commnents or issues raised in the individual letters.

<IMG SRC 98166J>

March 23, 1998

Stephen McCracken
Project Manager
Department of Energy
7295 Highway 94 South
St. Charles, MO 63304

RE: Weldon Spring Quarry Proposed Plan

Dear Mr. McCracken:

The Department of Health (MDOH) has reviewed the Proposed Plan and associated documents for the Weldon Springs Quarry Site in Weldon Spring, Mo. MDOH is encouraged by the decision of the US Department of Energy to take a proactive approach to reduce contamination north of the slough. Alternative 3, Groundwater Removal at Selected Areas, with On-Site Treatment, is acceptable to our office if the well contingency plan is determined to be protective of the St. Charles County water
A-1 supply. MDOH requests the opportunity to review this plan before it's approval. As MDOH has stated in the past, our concern is for the continued protection of the St. Charles County well field, therefore, our office would like to be assured that there will be appropriate monitoring, action levels set, and a response plan in place to address any threat to the public water supply in the event of contamination progressing south of the slough.

We appreciate the opportunity to participate in this matter. If you have any questions, please contact Pam Holley at (573) 751-6111.

<IMG SRC 98166K>

dr/sc/ph

cc: Larry Erickson, MDNR



Response A-1

The DOE recodnizes the importance of the monitoring effort described in the Well Field Contingency Plan (DOE 1998d) for protecting the well field. This plan has been made available for review and comment. All input or comments will be considered to make this plan protective of the St. Charles County well field. It is our intent that the contingency plan provides for adequate monitoring, action levels, and appropriate actions ranging from increased monitoring to the relocation of the well field if indicated by the data.



<IMG SRC 98166L>

Steve McCracken
Project Manager
U.S. Department of Energy
Weldon Spring Site Remedial Action Project
7295 Highway 94 South
St. Charles, MO 63303

Re: Feasibility Study for Remedial Action for the Quarry Residuals Operable Unit at the Weldon Spring Site, Weldon Spring, Missouri, March 1998; and Proposed Plan for Remedial Action for the Quarry Residuals Operable Unit at the Weldon Spring Site, Weldon Spring, Missouri, March 1998

Dear Mr. McCracken:

We have reviewed the above referenced reports and cannot yet concur with the proposed remedial alternative as described therein.

The Department of Energy (DOE) has stated that complete cleanup of groundwater at

the Weldon Spring quarry is not warranted by the likelihood of radioactive and chemical
B-1 contamination reaching the St. Charles County wellfield, and that subsurface hydrogeological conditions make such cleanup technically practicable. The Missouri Department of Natural Resources (MDNR) believes that the data and their uncertainties warrant active remediation of contaminated groundwater to achieve groundwater cleanup standards and disagrees with an approach that calls for monitoring only.
B-2 MDNR does agree that a demonstration to determine practicality of a groundwater cleanup is necessary; however, we disagree that the existing data shows this to be impractical.

Complying with groundwater cleanup standards (i.e., the Applicable or Relevant and Appropriate Requirements (ARARs)) is not contingent on demonstrating the cleanup is practicable. The demonstration of technical impracticability should not be the only or
B-3 even primary goal of the proposed remedy. Rather, the first goal of the proposed remedial alternative must be achieving the groundwater cleanup standards. If after a good faith attempt to implement the remedy, achieving the cleanup standards is not practicable, then those standards may be waived.

B-4 The proposed remedy does not appear to have as its goal achieving the groundwater cleanup standards. The proposed remedial alternative clearly is intended to provide the



Response B-1

Evaluations based on over 10 years of monitoring data and various field studies supporting the remedial investigation (RI)(DOE 1998c) indicate that impact from quarry contamination is limited to north of the Femme Osage Slough. Data collected from the well field indicate conditions consistent with the naturally occurring conditions in the upgradient Darst Bottoms. Further, the tightness of the aquifer, affinity of the soil for uranium, and redox conditions present in the quarry area north of the slough contribute to the relatively small and slow migration of uranium to the well field; these very same features, in turn, do not allow for effective removal of the uranium from the system.

Response B-2

Ample data are available to indicate that current conditions at the well field are protective of human health and the environment. The selected action calls for long-term monitoring. However, additional data will be collected via a pilot-scale trench to evaluate the need for and

effectiveness
of groundwater remediation. The data collected will be used to verify predictive models relating to
groundwater remediation and support the hydrological, geochemical, and contaminant fate and transport models for the quarry area.

Response B-3

The goal of the selected action is to ensure protection of human health and the environment.
The selected action complies with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, requirements. It is expected that the selected action will meet
all ARARs identified in the ROD. Establishing technical impracticability would only be necessary
in the event the selected action was not able to meet a particular applicable or relevant and
appropriate requirement (ARAR).

Response B-4

See responses B-2 and B-3. The MDNR will have the opportunity to provide input to define
additional field measurements that would supplement the current database and increase confidence
in the evaluations that support the decisions for the QROU.



September 1998

Mr. McCracken
Page two

necessary data to demonstrate technical impracticability and waive the groundwater cleanup standards. MDNR does not object to further investigations in this area, and we
B-4 reiterate our offer to work with DOE to define a set of performance-based criteria necessary and sufficient to justify the granting of such a waiver if supported by data from the field.

To the extent the Proposed Plan is not explicit on the goal of achieving groundwater cleanup standards, the Proposed Plan should be revised to state:

1) The goal of the proposed remedial alternative is achieving groundwater cleanup standards,
B-5
2) How the proposed remedial alternative will achieve that goal, and

3) The implementation of the remedial alternative will continue unbi ARARs are attained or until waived.

B-6 We do not object to the Proposed Plan including as an additional goal the collection of data intended to demonstrate technical impracticability.

Specifically, several significant issues remain unresolved:

- The Proposed remedy will not attain ARARs. The National Contingency Plan at 40 CFR 430(f)(1)(ii)(B) requires that "On-site remedial actions selected in a ROD must attain those ARARs that are identified at the time of [Record of Decision (ROD)] signature or provide grounds for invoking a waiver. The proposed remedy
B-7 will not attain ARARs for uranium or for some nitroaromatics. If DOE does not plan to attain ARARs, a waiver of the ARAR should be obtained before the ROD is signed. MDNR reiterates its offer to work with DOE to define a set of criteria necessary and sufficient to justify granting a Technical Impracticability waiver of ARARs.

- The Proposed remedy leaves the cleanup of the guarry incomplete. Currently, there are no cleanup levels provided for the remaining contaminated material in the quarry
proper. Contamination, including flakes of yellowcake, remains in cracks and
B-8 crevices of the quarry floor and walls. This residual material is a concern because it
is a source of contamination to groundwater and because it involves a risk from direct exposure. DOE continues to postpone a final remedial action for contamination in the quarry proper to final restoration of the quarry.

- The Proposed remedy omits appropriate remediation qoals. DOE rejects containment as a remediation goal. DOE responds, "[T]he current goal of achieving
B-9 as much reduction as possible of the uranium present north of the slough is appropriate and adequate." *[A]chieving as much reduction as possible is not an appropriate remediation goal. The NCP at 40 CFR 430(f)(1)(ii)(B) requires that



Response B-5

The Proposed Plan (DOE 1998b) that was released for public comment was a final document and will not be revised per CERCLA protocols. With respect to groundwater standards, see responses B-3 and B-7.

Response B-6

See response B-2.

Response B-7

The selected action will meet ARARs; no ARARs have been identified for uranium in groundwater. For a detailed discussion of ARARs, see Section 9.2. of this ROD.

Response B-8

As part of the selected action described in Section 8 of this ROD, the DOE has proposed additional characterization at the northeast slope and drainage ditch area within the quarry proper.
These data would then be used to perform risk calculations consistent with the approach presented
in the BRA (DOE 1998a) for the QROU. If calculations indicate risks to be greater than the EPA's acceptable risk range of 10 -6 to 10 -4 for a recreational scenario, soil removal would be undertaken
to meet cleanup criteria presented in the chemical plant ROD (DOE 1993) for radionuclides.

In addition, quarry restoration by backfilling with soil is planned; this will prevent further
infiltration to groundwater of any residual yellowcake or flakes in cracks and crevices that may be
present.

Response B-9

Evaluations indicate already protective conditions at the quarry area and the well field. The
implementation of engineering methods to provide containment of the plume of contamination is not
warranted. In fact, current hydrological and geochemical models indicate contamination to be confined to the quarry area north of the slough. In addition, no ARARs have been identified that require containment.





B-10 "On-site remedial actions selected in a ROD must attain those ARARs that are identified at the time of ROD signature or provide grounds for invoking a waiver."

Plume containment should be included as a remediation goal. DOE states, "The primary remediation goal for the QROU is to reduce the amount of uranium in quarry groundwater north of the slough, thereby reducing the amount of uranium that could migrate to the St. Charles County well field." Plume containment could be effected under the proposed alternative by either active means (e.g., continued water extraction from the trench after groundwater cleanup standards are achieved) or passive means (e.g., grouting the trench after active measures are completed).

B-11 Including plume containment as a remediation goal is appropriate since 1) as stated in the Proposed Plan, "migration of uranium to the county well field is possible and could be occurring (probably at very low rates)" (MDNR believes the Draft Final Proposed Plan describes the situation more accurately, i.e., migration of uranium "is most likely occurring (albeit at very low rates)."); 2) any contamination which migrates into the alluvium south of the Femme Osage Slough cannot leave the alluvium other than through the public wells (QROU Remedial Investigation, Figure

8-19 at p. 8-33); 3) current DOE plans leave residual contamination in the quarry proper which is a source of further groundwater contamination; and 4) migration of any contamination into the public water supply should be avoided.

- Groundwater cleanup levels are not achieved throughout the area outside the quarry proper. Groundwater contamination outside the quarry proper and north of the Femme Osage Slough exceeds groundwater cleanup standards. DOE proposes that the area south of the Femme Osage Slough (i.e., the "RMW" monitoring wells)
B-12 as the point of compliance, for demonstrating compliance with groundwater cleanup standards. This conflicts with EPA guidance that "groundwater cleanup standards should generally be attained throughout the contaminated plume, or at and beyond the edge of the waste management area, when the waste is left in place." Since the proposed remedy leaves waste within the quarry proper that must be managed, the quarry proper constitutes a waste management area outside of which cleanup levels must be achieved.

- A two-year implementation period is inappropriate. DOE specifies only a two-year "implementation peperiod" for the remedial action "to gauge the performance of this proposed action" and to reevaluate the need for waivers of the nitroaromatic ARARs. MDNR does not object to periodic reviews of the remedy's performance. However, in response to our comment that no fixed time period would be appropriate, DOE
B-13 stated, "if the reduction achieved [in two years] is as estimated or greater, the goal of
providing as much reduction as possible would have already been achieved. The implementation of the action beyond the two-year period proposed would not be cost-effective in light of the acceptable and protective conditions that exist in the well
field and the contingencies already planned for the wellfield via the Wellfield Contingency Plan."



Response B-10

See response B-3.

Response B-11

See response B-9.

Response B-12

See Response B-7 and Section 8 of this ROD.

Response B-13

Data collection involving a trench will be conducted for up to two years: at which time, data
collected will be compared with a predetermined set of performance goals. If performance of the removal system exceeds the performance goals, the need for and effectiveness of groundwater remediation will be reevaluated. However, if the performance is less effective or within the specified

performance goals, then further evaluation of groundwater remediation will not be necessary (see Section 8 of this ROD).





An understanding or clarification needs to be given that explains how the remedial action can go forward, beyond the two-year period, if the effectiveness exceeds estimates. It is unclear how the Department of Energy can deem an action as "not
B-14 cost-effective" at the time, even though future actual performance data may exceed modeling estimates. It would appear that if actual contamination reductions are greater than model estimates, this would support the decision to continue active remediation until ARARs are achieved.

Review of the Wellfield Contingency Plan is not complete. The 1988 draft version of the Wellfield Contingency Plan referenced in the Proposed Plan was received after the Feasibility Study and Proposed Plan were submitted for public comment. The Proposed Plan takes credit for the Wellfield Contingency Plan, which describes
B-15 groundwater monitoring, action levels, and planned responses to gensure the safety of drinking water supplied to residents of St. Charles County from this wellfield. Concurrence with the Proposed Plan is not possible until a review of the Wellfield Contingency Plan is complete.

Natural resources damages are not assessed. The Director, Missouri Department of Natural Resources, is the State of Missouri's trustee for natural resources. Pursuant to Section 107(f) of CERCLA or Section 311(f)(5) of the Clean Water Act, the state trustee for natural resources may act on behalf of the public to assess and recover
B-16 damages to natural resources. The proposed remedial alternative will leave contaminated groundwater to confinue to threaten the St. Charles County wellfield and may limit the ability to expand production of the wellfield to provide drinking water to residents in this rapidly growing area. Natural resources damages have not yet been assessed. This may need to be in the Record of Decision.

We look forward to working with you to resolve these issues and executing a Record of Decision which is protective of human health and the environment and attains all applicable or relevant and appropriate laws and regulations. If you have any questions, please contact Larry Erickson at (573) 751-6838.

Sincerely,

DIVISION OF ENVIRONMENTAL QUALITY

<IMG SRC 98166M>

Response B-14

See Response B-13.

Response B-15

The most recent draft of the Well Field Contingency Plan was distributed for agency review on March 17, 1998. As stated in response A-1, input and comments provided on this plan will continue to be considered and incorporated, as appropriate, to ensure that protection of the well field is as comprehensive as possible.

Response B-16

The assessment to address natural resource damages does not occur as part of the remedy selection process. These issues are addressed following performance of remedial activities.



Weldon Spring Citizens Commission
100 N. Third Street
St. Charles, MO 63301

May 21, 1998

Mr. Stephen H. McCracken, Project Manager
U.S. Department of Energy
Weldon Spring Site Remedial Action Project Office
7295 Highway 94 South
St. Charles, Missouri 63304

Dear Mr. McCracken:

This letter is to serve as public comment from the Weldon Spring Citizens Commission on the Proposed Plan for Remedial Action at the Quarry Residuals Operable Unit of the Weldon Spring Site, March 1998, DOE/OR/21548-724. This response is in fulfillment of the Commission's primary goal which is "To ensure that the public has a voice in the safe and timely completion of the Weldon Spring project." One of the primary stated objectives that guided the Commission in formulating their response was "to maximize the quality of the cleanup while minimizing the impact to the surrounding environment and the public." Our written responses to the proposal described above are intended to reflect the collective perceptions, considered opinions, and concerns of informed local Citizens who have a demonstrated interest in both short term and long term consequences of the remediation efforts of the WSSRAP

The Commission unanimously supports the Department of Energy's "alternative # 2" (monitoring with no active remediation) as described in the Proposed Plan for Remedial

Action at the Quarry Residuals Operable Unit of the Weldon Spring Site, March 1998.
C-1 The decision was reached after an exhaustive review of information evaluated over the last five months including independent technical review provided to the Commission. Our comments first address the quarry proper followed by comments regarding the groundwater remediation.

We believe that restoration of the quarry is essential and should be restored to eliminate physical and radiological exposure. This should be done by filling and capping
C-2 the quarry with suitable material and taking whatever measures necessary to ensure that any residual contaminants do not migrate from the site. The Commission expects to be involved in the Remedial Design and Remedial Action Work Plan.



Response C-1

The DOE acknowledges the prefercnce of the WSCC for Alternative 2 (monitoring with no active remediation) described in the Proposed Plan (DOE 1998b).

Response C-2

The DOE is planning to perform quarry restoration by backfilling with soil as discussed in previous sections of this ROD. The WSCC will continue to be given the opportunity to review and provide input on subsequent reports or documents prepared in support of the QROU, as well as other Weldon Spring site activities.





With respect to the groundwater, the Commission believes that the first line of defense to an unforeseen event which would contaminate the drinking water is continued monitoring backed up by an updated Well Field Contingency Plan. We believe that data from continuous review of alternative #2 can accomplish our goals. This would include data from existing monitoring wells as well as new strategic monitoring wells. This will
C-3 insure that the integrity of the well field is not compromised by a change in the existing plume and will allow us to make appropriate responses if the integrity is compromised. The Commission will review the data for the existing and proposed monitoring wells within a year of the completion of the Quarry Restoration. This will allow the Commission to decide whether there should be a change in the scope and/or frequency of future monitoring.

With respect to the Well Field Contingency Plan, the Commission believes that the

plan is the only action to safeguard the drinking water if the monitoring proposed in alternative #2 shows migration of the plume toward the St. Charles County well field. This plan needs to be strengthened. The plan must state:

C-4

1. who will be responsible and update the implementation of the plan;
2. who will be involved in communicating the monitoring results if there is an increased presence of uranium in the water supply wells;
3. what will be the public involvement in the review and the evaluation of the plan.

The essential difference between alternative #2 and alternative #6 in the Proposed Plan for Remedial Action at the Quarry Residuals Operable Unit of the Weldon Spring Site, March 1998, was the construction of a trench to capture and remove residual groundwater contaminants. However, from the information provided to the Commission, there were serious doubts that the trench would be successful in reducing measurable amounts of contaminants. As stated, the best prediction called for only an 8-10% reduction in the mass of uranium over a two year period. With the stated length of operation of two years, this predicted amount of reduction does not, in our opinion, support the possible unforeseen risks of the disturbance of the natural barrier. In addition, possible other negative effects are: the chaining of the slough with increased contaminant concentrations, creating unknown pathways for the contaminants, breaking the natural barrier, and other technical reason as stated in the Feasibility Study for Remedial Action for the Quarry Residuals Operable Unit at the Weldon Spring Site, Weldon Spring Missouri, March 1998, DOE/OR/121548-595, page 4-17.



Response C-3

Under the selected action described in this ROD, monitoring would be performed to ensure that conditions continue to be protective of human health and the environment at the well field. The specific process to be undertaken regarding review of data will be defined in post-ROD remedial design/remedial action reports. The WSCC will have the opportunity to provide input into this process and associated reports.

Response C-4

The March 1998 version of the Well Field Contingency Plan (DOE 1998d) will be revised to incorporate comments received from various stakeholders. The DOE is responsible for updating and implementing this plan. Specific information requested in this comment will be provided in the revised version of the report, as appropriate.





We cite the August 21, 1997 Department of Energy's response to the Weldon Spring Citizens Commission's Comment #6 on the Remedial Investigation for the Quarry

Residuals Operable Unit of the Weldon Spring Site, Weldon Spring, Missouri: "A risk to
C-5 downgradient groundwater from concentrating uranium in soils in this area [north of the slough] could be the introduction of materials or a significant change in the natural system which might significantly alter the reducing nature of this area. Any change to a more oxidizing system would allow the precipitated uranium in the soil to become mobilized in the dissolved phase and migrate south of the slough."

In summary, the Commission unanimously supports alternative #2 and strongly urges the DOE to incorporate the recommendations submitted in this document in the final record of decision. The Commission would like to extend their gratitude to the Department of Energy for their candor and openness in providing the Commision with information as
C-6 well as responding to our numerous requests for clarification and explanations associated with this proposal. This type of cooperation has allowed the Commission to maintain its objectivity and impartiality. We hope this level of honest and open dialog will continue in the future and we appreciate the opportunity to offer a community perspective on this ongoing remediation effort.

<IMG SRC 98166N>

cc: Karen Reed, DOE
Dan Wall, EPA
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Response C-5

Construction of the trench should have little to no impact on the natural processes (adsorption and precipitation) presently mitigating the rudgration of uranium south of the slough. The high levels of uranium are present in an oxidizing portion of the aquifer; therefore, the trench would also be located in this portion of the aquifer. Because the trench will behave as a collection system, the groundwater will be pulled to this location. It is expected that the groundwater capture zone for this trench will not be large because of the fine-grained nature of the Soils. South of the trench, a reducing zone is present that allows for the precipitation of uranium from the groundwater. The

operation of the trench will not result in oxidizing groundwater invading the reducing zone and resulting in its degradation or remobilization of uranium because of the small area of influence the trench will have in comparison to the size of the reducing area. Also, the installation of the trench will not impact the capacity of the existing soils to adsorb uranium.

Response C-6

The selected action described in this ROD was reached after consideration of all comments received, including those from the WSCC. The process for exchange of information and communication between the DOE and the WSCC is expected to continue as it has.



REFERENCES FOR APPENDIX A

U.S. Department of Energy, 1993, Record of Decision for Remedial Action at the Chemical Plant Area of the Weldon Spring Site, Weldon Spring, Missouri, DOE/OR/21548-376, prepared by Argonne National Laboratory, Argonne, Ill., for U.S. Department of Energy, Oak Ridge Operations Office, Weldon Spring Site Remedial Action Project, Weldon Spring, Mo., Sept.

U.S. Department of Energy, 1998a, Feasibility Study for Remedial Action for the Quarry Residuals Operable Unit at the Weldon Spring Site, Weldon Spring, Missouri, DOE/OR/21548-595, prepared by Argonne National Laboratory, Argonne, Ill., for U.S. Department of Energy, Oak Ridge Operations Office, Weldon Spring Site Remedial Action Project, Weldon Spring, Mo., March.

U.S. Department of Energy, 1998b, Proposed Plan for Remedial Action at the Quarry Residuals Operable Unit of the Weldon Spring Site, prepared by Argonne National Laboratory, Argonne Ill., for U.S. Department of Energy, Oak Ridge Operations Office, Weldon Spring Site Remedial Action Project, Weldon Spring, Mo., March.

U.S. Department of Energy, 1998c, Remedial Investigation for the Quarry Residuals Operable Unit of the Weldon Spring Site, Weldon Spring, Missouri, DOE/OR/21548-587, prepared by MK-Ferguson Company and Jacobs Engineering Group, Weldon Spring, Mo., for U.S. Department of Energy, Oak Ridge Operations Office, Weldon Spring Site Remedial Action Project, Weldon Spring, Mo., Feb.

U.S. Department of Energy, 1998d, Well Field Contingency Plan, Draft, prepared by MK-Ferguson Company and Jacobs Engineering Group, Weldon Spring, Mo., for U.S. Department of Energy, Oak Ridge Operations Office, Weldon Spring Site Remedial Action Project, Weldon Spring, Mo.